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SEPTEMBER 1952

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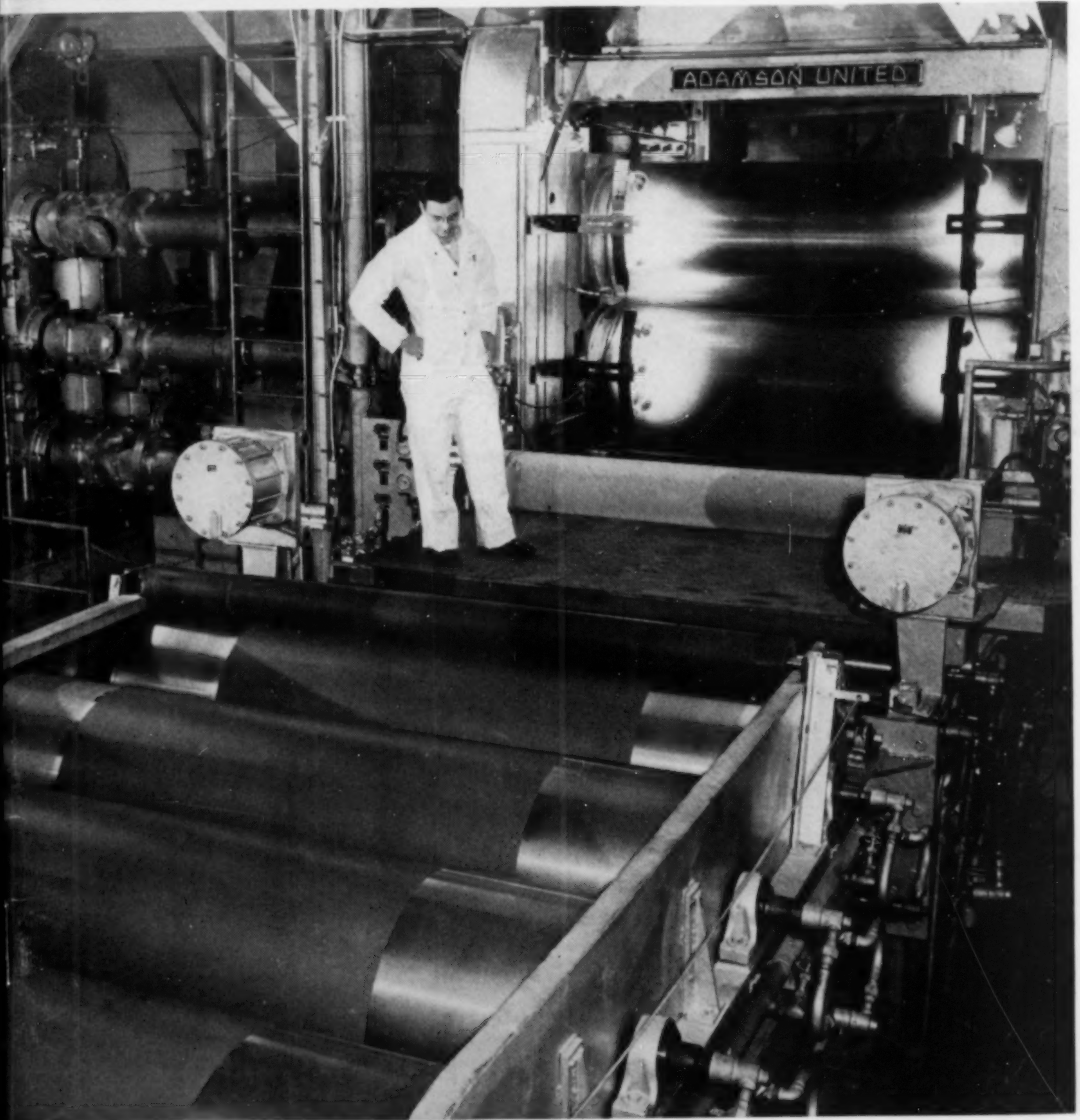


ROLLS TURN OUT
120 MILES A DAY
OF PLASTIC FILM

Calender in Goodyear Plant
Utilizes Air Power in
Several Operations

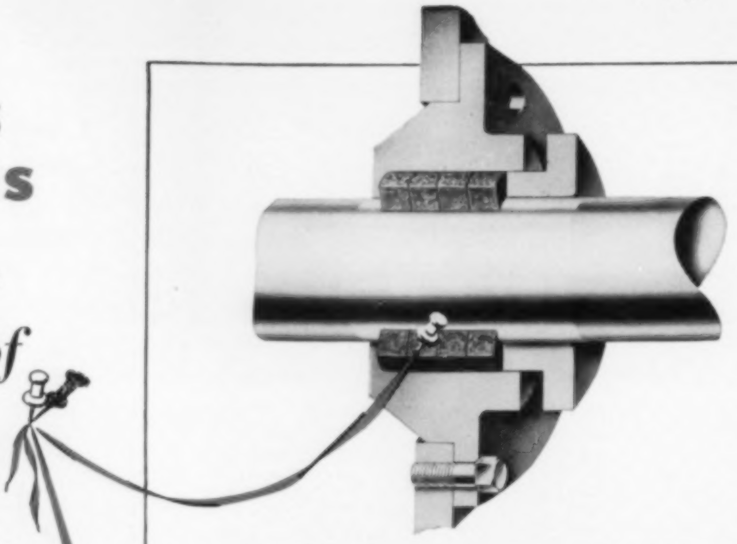
(SEE INDEX PAGE)

VOLUME 57 • NUMBER 9

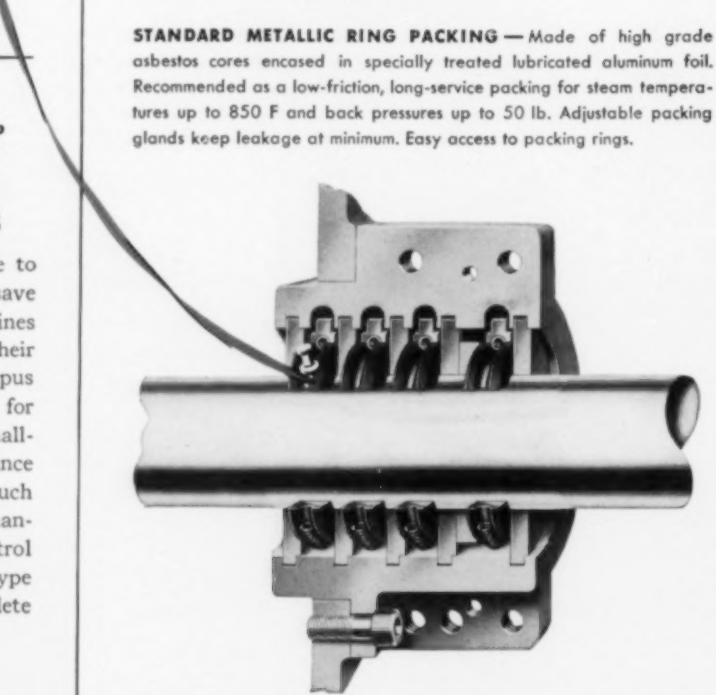
NEW YORK • LONDON

COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .

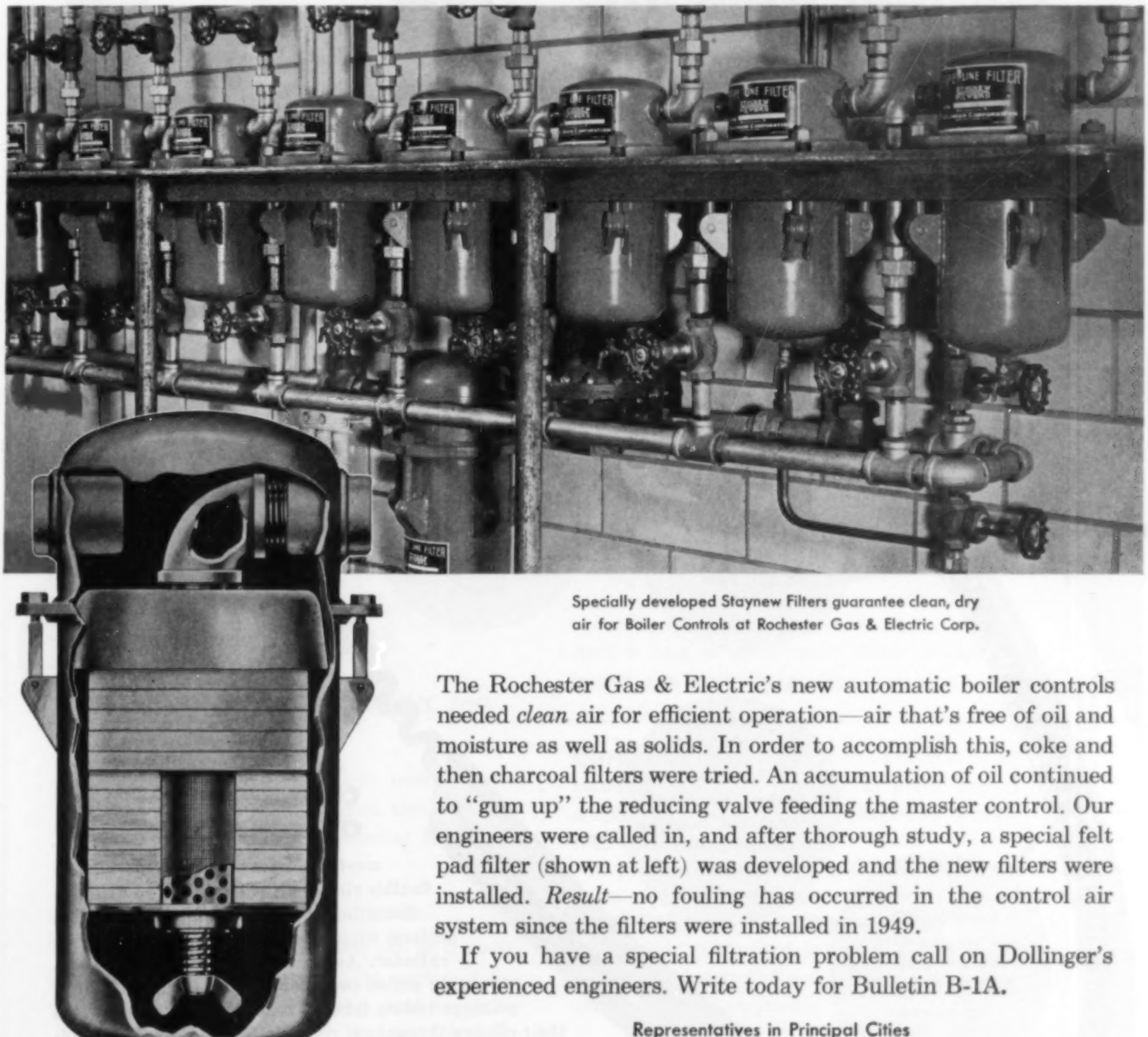
WRITE FOR BULLETIN 135

COPPUS
ENGINEERING
CORPORATION
209 Park Avenue
Worcester 2, Mass.
Sales offices in
THOMAS'
REGISTER

COPPUS "BLUE RIBBON" TURBINES

THESE STAYNEW ABSORPTION FILTERS

Protect Automatic Combustion Controls from All Oil, Moisture, Solids



Specially developed Staynew Filters guarantee clean, dry air for Boiler Controls at Rochester Gas & Electric Corp.

MODEL AAPH
Absorption Filter

The Rochester Gas & Electric's new automatic boiler controls needed *clean* air for efficient operation—air that's free of oil and moisture as well as solids. In order to accomplish this, coke and then charcoal filters were tried. An accumulation of oil continued to "gum up" the reducing valve feeding the master control. Our engineers were called in, and after thorough study, a special felt pad filter (shown at left) was developed and the new filters were installed. *Result*—no fouling has occurred in the control air system since the filters were installed in 1949.

If you have a special filtration problem call on Dollinger's experienced engineers. Write today for Bulletin B-1A.

Representatives in Principal Cities

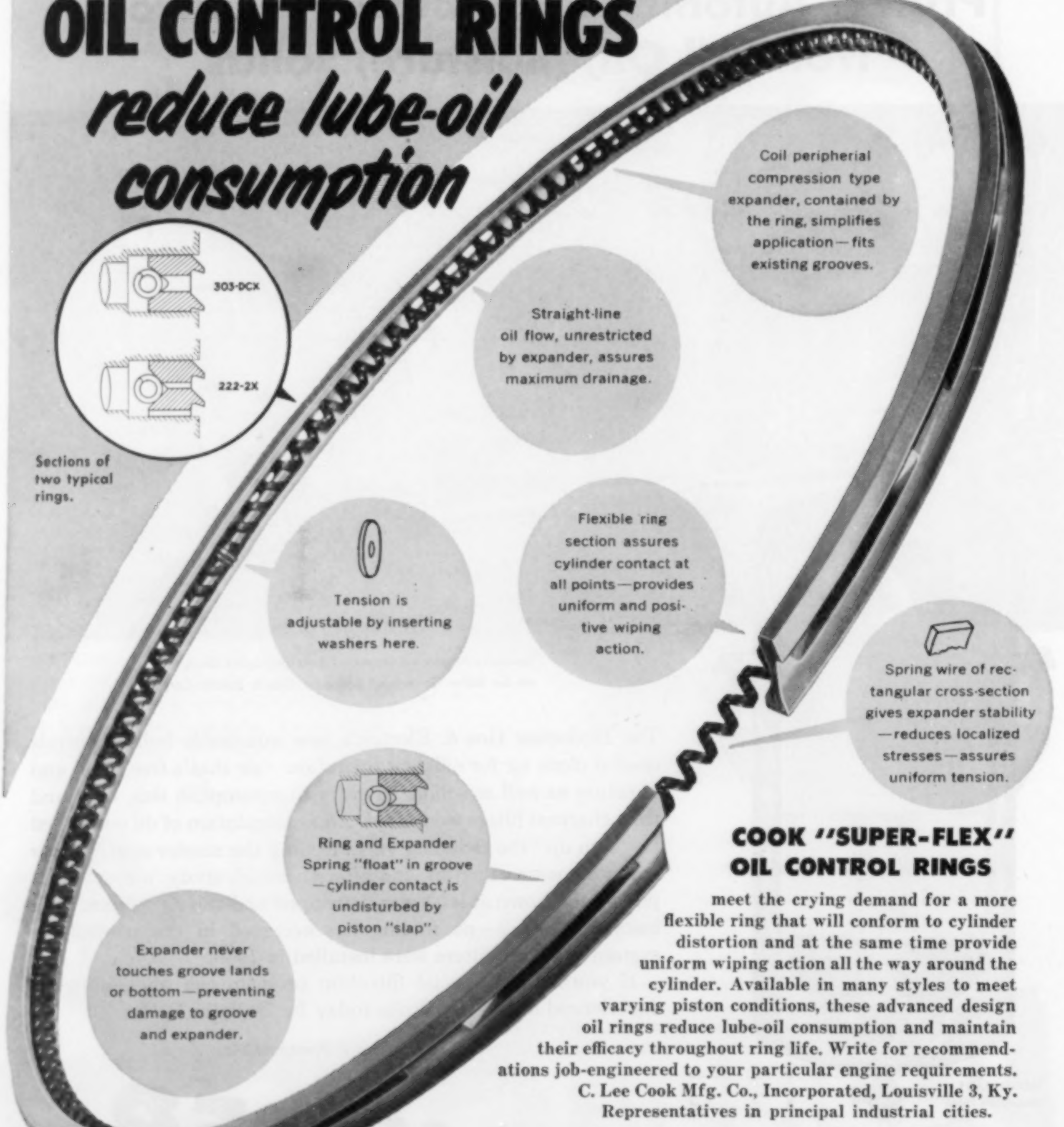
DOLLINGER
REG.
PROTECTOMOTOR
U.S. PAT. OFF.
STAYNEW FILTERS

DOLLINGER
CORPORATION
7 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

IN CANADA:
Toronto - McCarthy & Robinson, Ltd.
Montreal - Engineering Equipment Co., Ltd.
Vancouver - P. D. McLaren & Sons, Ltd.
Winnipeg - Mumford-Medland, Ltd.

Why COOK "SUPER-FLEX" OIL CONTROL RINGS *reduce lube-oil consumption*



Sections of two typical rings.

Coil peripherial compression type expander, contained by the ring, simplifies application—fits existing grooves.

Straight-line oil flow, unrestricted by expander, assures maximum drainage.

Tension is adjustable by inserting washers here.

Flexible ring section assures cylinder contact at all points—provides uniform and positive wiping action.

Spring wire of rectangular cross-section gives expander stability—reduces localized stresses—assures uniform tension.

Ring and Expander Spring "float" in groove—cylinder contact is undisturbed by piston "slap".

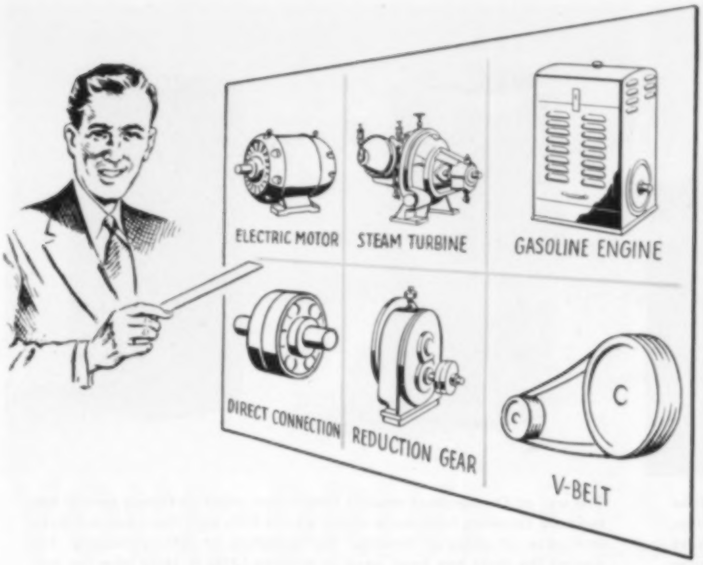
Expander never touches groove lands or bottom—preventing damage to groove and expander.

COOK "SUPER-FLEX" OIL CONTROL RINGS

meet the crying demand for a more flexible ring that will conform to cylinder distortion and at the same time provide uniform wiping action all the way around the cylinder. Available in many styles to meet varying piston conditions, these advanced design oil rings reduce lube-oil consumption and maintain their efficacy throughout ring life. Write for recommendations job-engineered to your particular engine requirements. C. Lee Cook Mfg. Co., Incorporated, Louisville 3, Ky. Representatives in principal industrial cities.

COOK
PISTON RINGS

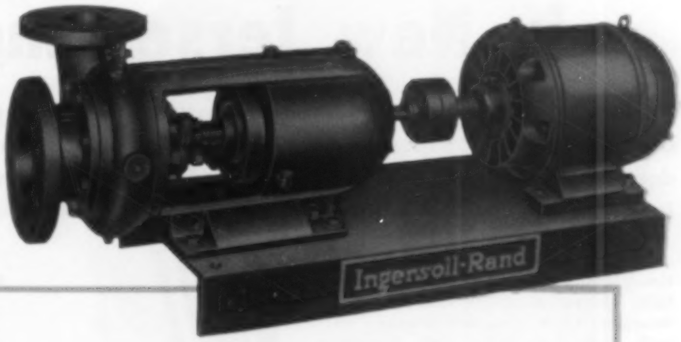
. . . SEALING PRESSURES SINCE 1888 . . .



Pick out ANY PRIME MOVER or ANY DRIVE

You'll find the RIGHT COMBINATION for your liquid-moving job in the complete line of I-R CRADLE-MOUNTED PUMPS

They are available in capacities from 5 to 2400 gpm with heads to 500 ft. No matter how "special" your requirements may be, you can get exactly what you want from this standard but superior line of Ingersoll-Rand pumps.



You get all these other advantages, too

Economy of Operation. These pumps are designed to maintain their original high efficiency year after year—making substantial long range savings in your power bills.

Low Maintenance. The driver can be removed or replaced without disturbing the suction or discharge connections to the pump. And the pump itself is easy to get at—with plenty of room to inspect and renew the packing.

Extra Dependability. Careful selection of all materials and extra precision in every step of manufacture mean longer, trouble-free service, even on the toughest jobs.

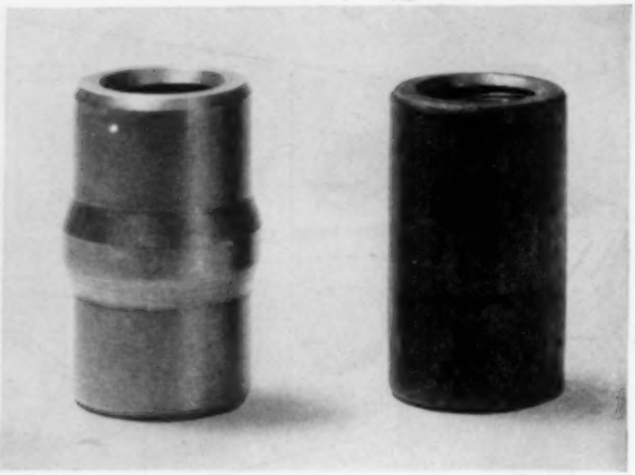
Quick Delivery. By maintaining large stocks of all standard parts used in the Cradle-Mounted Pump line, Ingersoll-Rand is able to make unusually prompt shipments.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.
778-9

Your nearest I-R representative will be glad to give you further details and help you select the pump that's best suited to your requirements.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

Ralph J. Catanzarita (left), drill-steel-shop foreman at Scrub Oaks Mine, discusses his patented drilling tools with T. M. Leisenring, Bethlehem salesman. The short rods are coupled to demonstrate positions of the bit, bit adapter, extension-rod coupling, and reducer coupling. Note water tube inserted in the ring-sealed shank.



The use of Omega tool steel (a Bethlehem shock-resisting grade) has reduced coupling failures to about one in 500; and there has not been one case of stripped threads. The coupling at left is unused. The one at the right has been used in drilling 1700 ft. Note how the outside wearing surfaces have been worn down by the abrasive rock.

Deep holes drilled with coupled rods in New Jersey magnetite mines

Coupled rods of Bethlehem Hollow Drill Steel are used regularly in drilling holes from 35 to 135 ft deep at the Scrub Oaks and Oxford Mines, both located in the historic magnetite belt of northern New Jersey. Holes more than 150 ft deep have been drilled on several occasions. Both mines report substantial savings in time, powder, and overall drilling costs as compared with previous drilling practice.

Hollow drill steel, 1¼-in. round, with ring-sealed shanks, are the "drive rods"—usually in lengths of 4½ and 8½ ft. After a hole is started with the two lengths of drive rods, an 8½-ft extension rod of 1-in. hexagon steel is attached to the shorter drive rod by means of a reducer coupling. On the end of this extension rod a bit-adapter is attached, and a carbide-insert bit is fitted to the adapter. The bit adapter serves as a bearing and helps to keep the string of rods from wandering out of line; it also pulverizes the cuttings for easy hole-cleaning. As drilling progresses, other extension rods of 8½-ft length are added, through the use of a unique coupling.

Drifter drills are securely mounted and fitted with an air-and-water valve for efficient hole-cleaning; extra-long water tubes are used. Various other modifications of normal drilling practice are used at these mines to insure best results on long holes.

Here's enough drill steel to drill a 100-ft hole. The ten extension rods of 1-in. hexagon, 8½-ft long, are threaded at both ends. Two drive rods, nearest camera, are 1¼-in. round. A 3-in. bit and a bit adapter are shown attached to the shorter drive rod, although in actual drilling these are attached to the leading extension rod.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

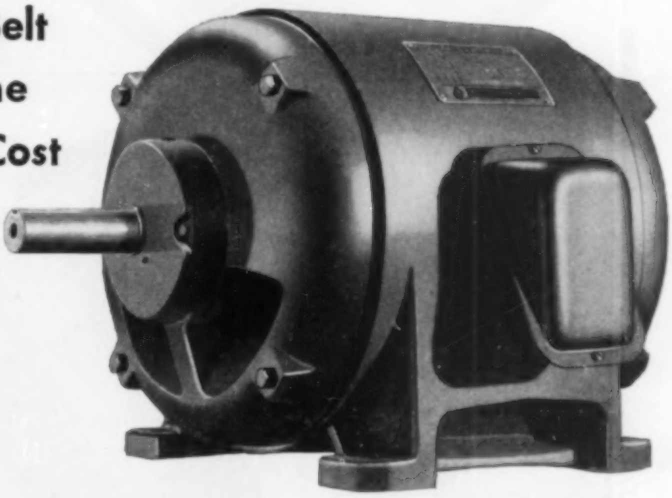
On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Bethlehem Hollow Drill Steel

ALLIS-CHALMERS
COMPLETE DRIVES

Simplify
YOUR DRIVE DESIGN PROBLEMS

Allis-Chalmers Matched Motors, Control and V-Belt Drives Save Design Time and Cut Manufacturing Cost



CONTROL

Complete matched control for any motor, including manual and magnetic starters, pushbuttons, and variable speed control.

MOTORS Standard open drip-proof, splash-proof, totally-enclosed, fan-cooled and explosion-proof, ½ hp and up. Also wound rotor and direct current. Special motors to meet your requirements.

Texrope V-BELT DRIVES Fixed speed and *Vari-Pitch* sheaves with stationary or motion control. Famous grommet belt construction. Most complete line of V-belt drive equipment in the industry.

Get the Kind of Help You Need

Allis-Chalmers representatives in every industrial center are at your command. Just call the office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin for helpful literature.

Allis-Chalmers Motors and Control	51B6052
Texrope V-Belt Drives	20B6051

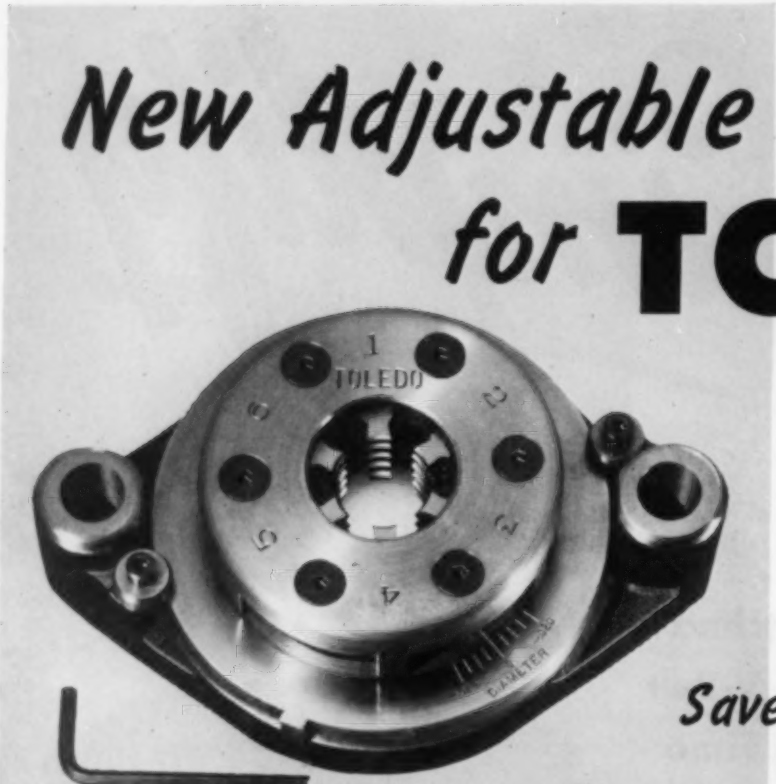
Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

A-3640

ALLIS-CHALMERS A-C ALLIS-CHALMERS

New Adjustable Die Heads for TOLEDO

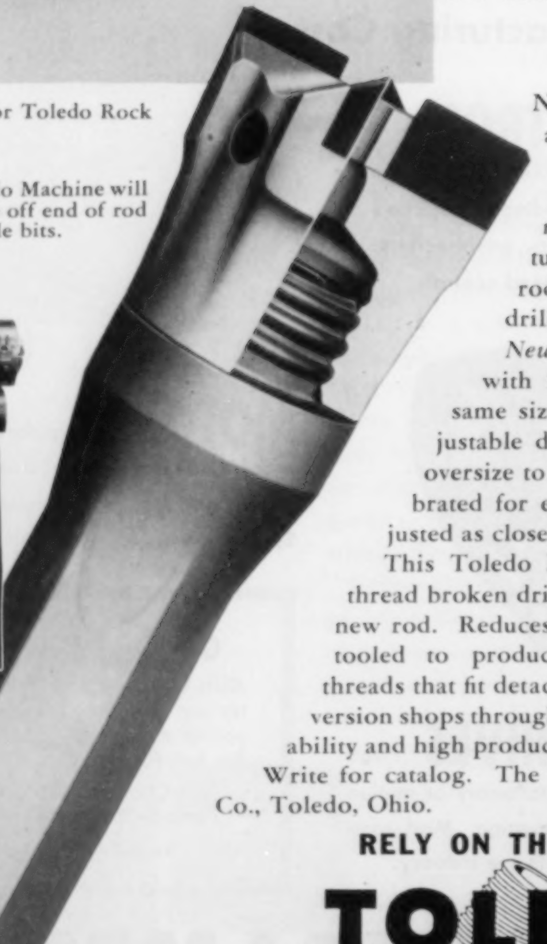
ROCK DRILL ROD MACHINE



New adjustable die head for Toledo Rock Drill Rod Machine.

After rod is annealed, Toledo Machine will turn to size, thread and face off end of rod to a perfect fit for detachable bits.

Toledo Rock Drill Rod Machine



Save Time . . . Reduce Cost in threading drill rods on the job!

Now — another advanced feature added to Toledo Rock Drill Rod Machines . . . today's widely used efficient, high production power machine that does all necessary turning, threading and reaming on rods for detachable bits used in rock drill operations.

New adjustable die heads now available with 1½" or 1-27/32" bore will take same sizes of threads as previous non-adjustable die head. Adjustable from .020" oversize to .020" undersize. Accurately calibrated for every .005". Die head easily adjusted as close as .001" on diameter.

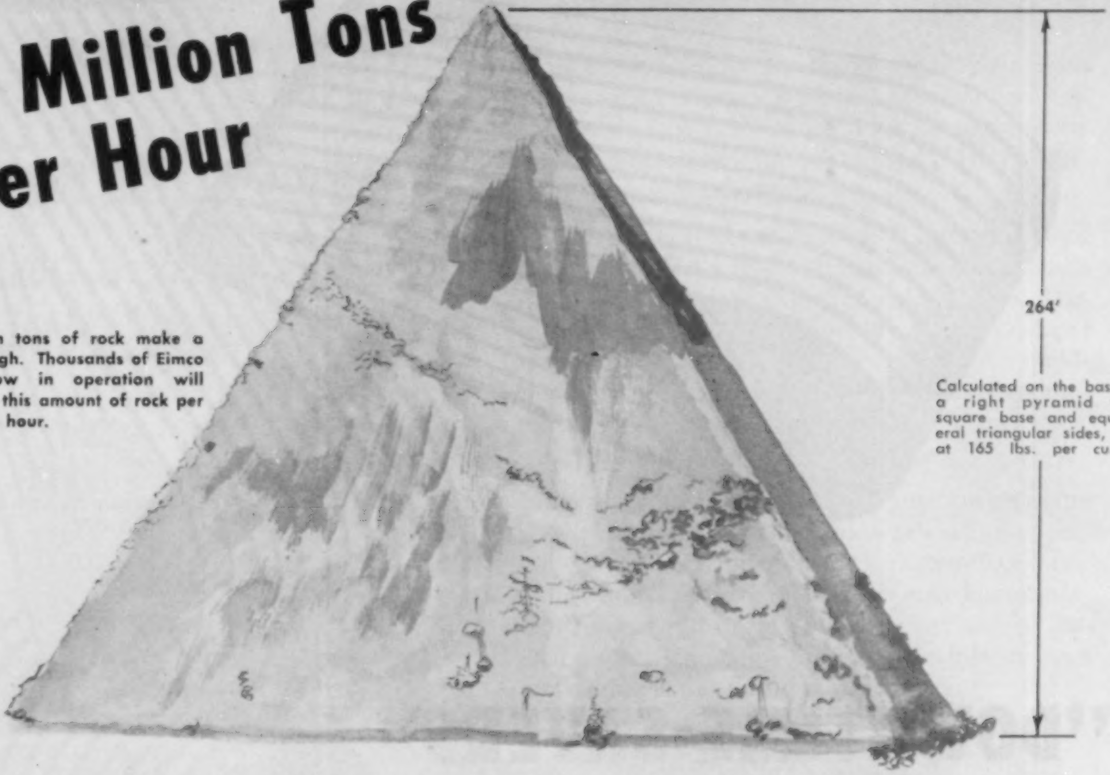
This Toledo Machine will thread new or rethread broken drill rod at a fraction of the cost of a new rod. Reduces downtime and expense. Can be tooled to produce Ingersoll-Rand and Timken threads that fit detachable bits perfectly. Used in conversion shops throughout the country . . . where dependability and high production, precision work are required. Write for catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio.

RELY ON THE LEADER

TOLEDO

FOR ROCK DRILL ROD MACHINES

One Million Tons Per Hour



One million tons of rock make a pile 264' high. Thousands of Eimco loaders now in operation will easily load this amount of rock per hour, every hour.

Calculated on the basis of a right pyramid with square base and equilateral triangular sides, rock at 165 lbs. per cu. ft.

MOST TUNNEL DRIVERS USE EIMCOS:

Shown below are pictures of Eimco equipment used in driving five famous tunnels. Eimcos have been used on scores of other tunnels.

MOST HARD ROCK MINERS USE EIMCOS:

Shown below are pictures of Eimco loaders used in several mines. Hundreds of others are being used in mining properties throughout the world.

Eimco loaders are preferred equipment wherever rock is loaded underground. The Eimco quality of material and manufacture assures the user of dependability on the job. Greater economies in operating costs and time are available only with Eimco Loaders. Write for information on the Eimco to fit your job.

EIMCO

A393

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

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IN ITALY: EIMCO ITALIA, S.P.A., MILAN, ITALY

"DOWNTIME-SAVERS"

Condor V-BELTS

You save downtime for belt take-up and belt replacement when you use Condor V-Belts. There are good reasons . . . Condor V-Belts are destretched and balanced by R/M engineering during manufacture . . . and they are made with straight sidewalls for more grip. As a result, each Condor V-Belt in a multiple drive pulls its share of the load without stretching, sagging or slipping. That's why, all Condor V-Belts run longer, save time and money • Bulletin 6868-E, "Grips the Grooves," describes other advantages of the "Smoothest Running V-Belts Made." Write for it, or call your R/M Distributor.

R/M

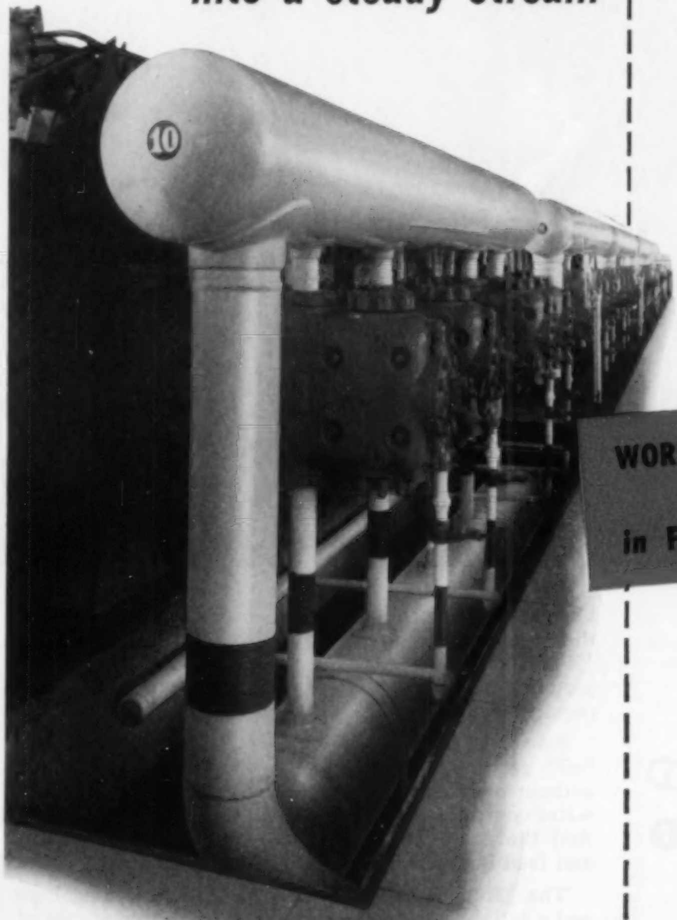
MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS - MANHATTAN, INC.

Flat Belts · V-Belts · Conveyor Belts · Hose · Roll Covering · Tank Lining · Abrasive Wheels

Other R/M products include: Industrial Rubber - Fan Belts - Radiator Hose - Packings - Brake Linings - Brake Blocks
Clutch Facings - Asbestos Textiles - Sintered Metal Parts - Bowling Balls

FLUOR
Pulsation Dampeners
convert a pulsating flow into a steady stream



How do you reduce the throbbing in your plant piping—with oversized piping and heavier wall thicknesses? With reinforced structure supports and mechanical vibration dampeners? How accurately are you metering gas?

Fluor Pulsation Dampeners work at the cause of the trouble. Their unique design principle smooths out pulsations to the extent of at least 85%. This means that damage to piping, coolers, heat exchangers, processing equipment and even buildings will be eliminated. It means reduced maintenance, more accurate gas metering and smoother, safer, more efficient plant operation.

Fluor Pulsation Dampeners are used on any type gas stream—air, steam, hydrocarbons—at operating pressures ranging from vacuum to 5,000 psi. Dimensions can be tailored to fit space limitations. Units may be installed on the suction and/or discharge lines and are sufficiently flexible to meet minimum pressure drop requirements.

WORKMANSHIP and PERFORMANCE are guaranteed in FLUOR PULSATION DAMPENERS

Performance and workmanship are guaranteed in every instance where a Fundamental Pulsation Dampener or Pulsation Dampening System is installed. Here are excerpts from the guarantee:

> *"The Fluor Corporation, Ltd., guarantees that the pulsation dampeners or pulsation dampening systems . . . conform to all specific code requirements, and the workmanship is in accordance with standard shop practice by qualified welders."*
>
> *". . . that the equipment will satisfactorily correct conditions of piping vibrations which are due to excessive pulse pressure in the piping system, or correct inaccurate gas metering caused by pulsative flow . . ."*
>
> *". . . that the dampeners or pulsation dampening systems will decrease the magnitude of the pulse pressure in the compressor plant header piping to a value not to exceed 1.25 percent of the compressor operating pressure. The above percentage reduction applies to both suction and discharge pulsation dampeners or dampening systems . . ."*
>
> *". . . that the pulse pressure in the plant header piping will not exceed the pulse pressure which is measured in the lateral between the volume bottle and the suction or discharge header, respectively."*
>
> *". . . that the total pressure loss through the pulsation dampeners or pulsation dampening systems, measured by means of a differential pressure indicator and expressed in pounds per square inch, will not exceed the value set forth on the attached Dimensional Outline Sheet or layout drawing . . ."*

Contact your nearest Fluor representative for the answer to your specific pulsative flow problems. Following preliminary study, he will be pleased to recommend the Fluor Pulsation Dampener that best fits your particular requirements. Or, write The Fluor Corporation, Ltd., Los Angeles 22, California.

Two Fluor "Package Type" Models

Fluor Pulsation Dampeners are available in two models: the Fundamental and the Higher Frequency. The Fundamental is recommended for installation in all compressor piping systems where excessive vibration is caused by peak pulse pressures at the fundamental frequency. The Higher Frequency Pulsation Dampener is recommended where frequencies are encountered above the fundamental (second harmonics or higher frequencies).

The Fluor Pulsation Dampening Piping System

Designed primarily for new construction, Fluor Pulsation Dampening Piping Systems are furnished in prefabricated form, ready for installation. Systems are designed for any type gaseous stream at operating pressures ranging from vacuum to 5,000 psi. Advantages include: improved flow measurement, fewer maintenance requirements, protection of related equipment, and smooth operation of plants and stations at rated capacity. Write for Bulletin PDS-8501.

FLUOR

Engineers – Constructors – Manufacturers

THE FLUOR CORPORATION, LTD. · LOS ANGELES · HOUSTON
New York, Chicago, Pittsburgh, Boston, Tulsa, San Francisco, Birmingham and Calgary

Represented in the Sterling areas by:
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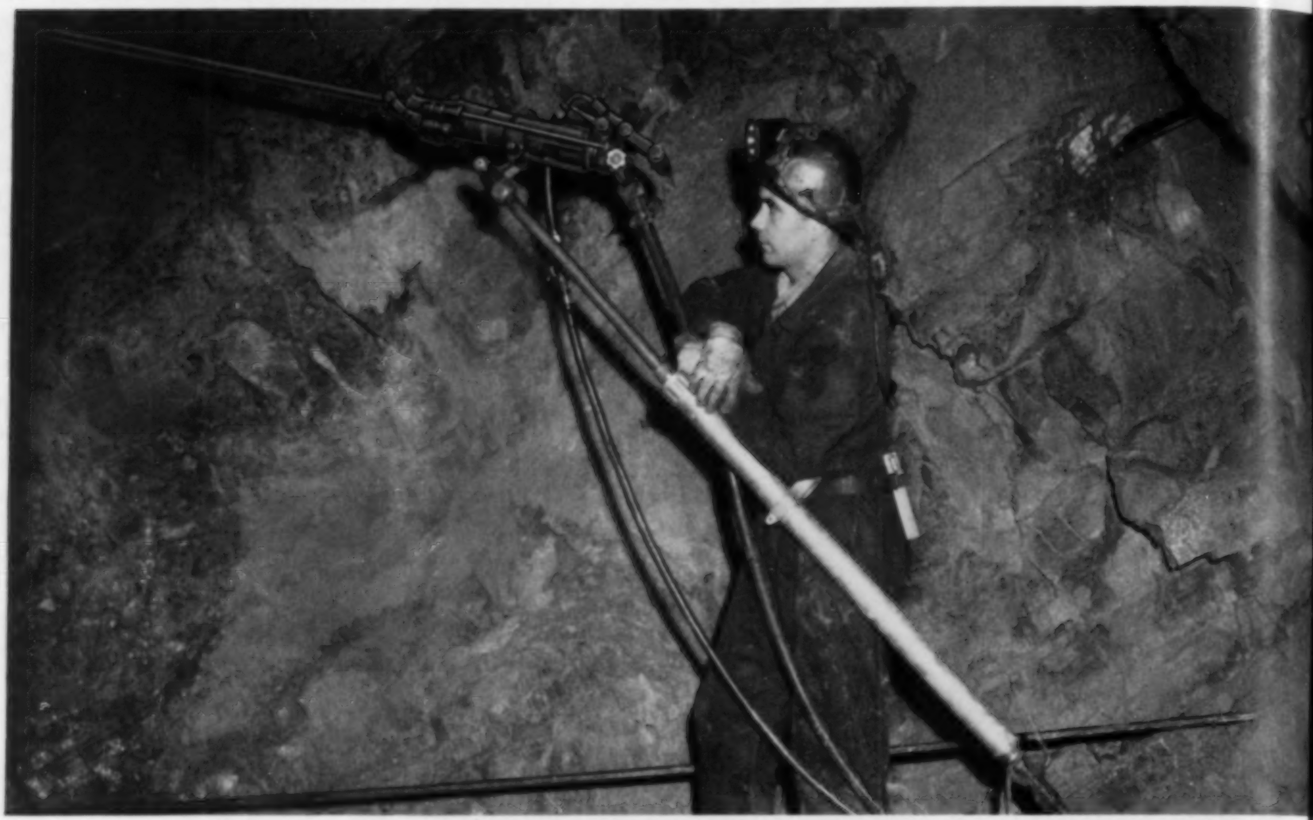
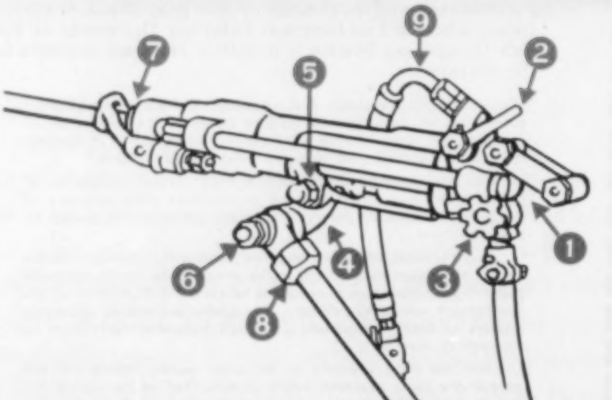
SINCE 1890

BE *sure* WITH FLUOR

ANOTHER BIG ADVANCE IN





Never before have you been offered a Jackleg drill that would do *so much—so easily*. That's because the JR-38 Jackdrill is not just an adaptation, but a completely integrated unit designed to meet your every requirement.

Since the throttle valve shuts off feed-leg air in the "off" position, the leg can be shortened or removed without even closing the feed-leg valve. Automatic air-water control avoids the need for separate adjustments. And the exclusive built-in air coupling between drill and feed leg does away with the third hose.

The JR-38 is supplied with 2′, 3′ and 4′ feed legs, and a full range of drill rotations. With a total weight of only 88 lbs. using the 3 foot feed, this is without question one of the lightest drilling units of its power ever developed.

Ask your Ingersoll-Rand representative to demonstrate the JR-38.

Here are the FEATURES you've been waiting for in a Jackleg Drill:

1. All controls grouped in fixed position on drill backhead.
2. Five-position throttle gives unified control of all operations, as follows:
   - Blowing Position — drill and air feed off
   - Off Position — drill and air feed off.
   - Feed Position—air feed on, drill off.
   - Collaring Position—automatic water and air feed on, limited air to drill.
   - Drilling Position—full air to drill and feed.
3. Feed leg control valve is built into the backhead.
4. Air connection through mounting support eliminates separate air hose to feed leg—air to leg goes through the drill.
5. Balance can be adjusted to suit operator by loosening and tightening one nut.
6. Adjustable tension on hinged joint.
7. Constant chuck blowing keeps hole free of cuttings—keeps cuttings out of drill.
8. Air feed leg easily detached by loosening one nut. Drill can be used separately as a Jackhamer.
9. Location of water connection improves balance — keeps hose out of the way.

N ROCK DRILL DESIGN!

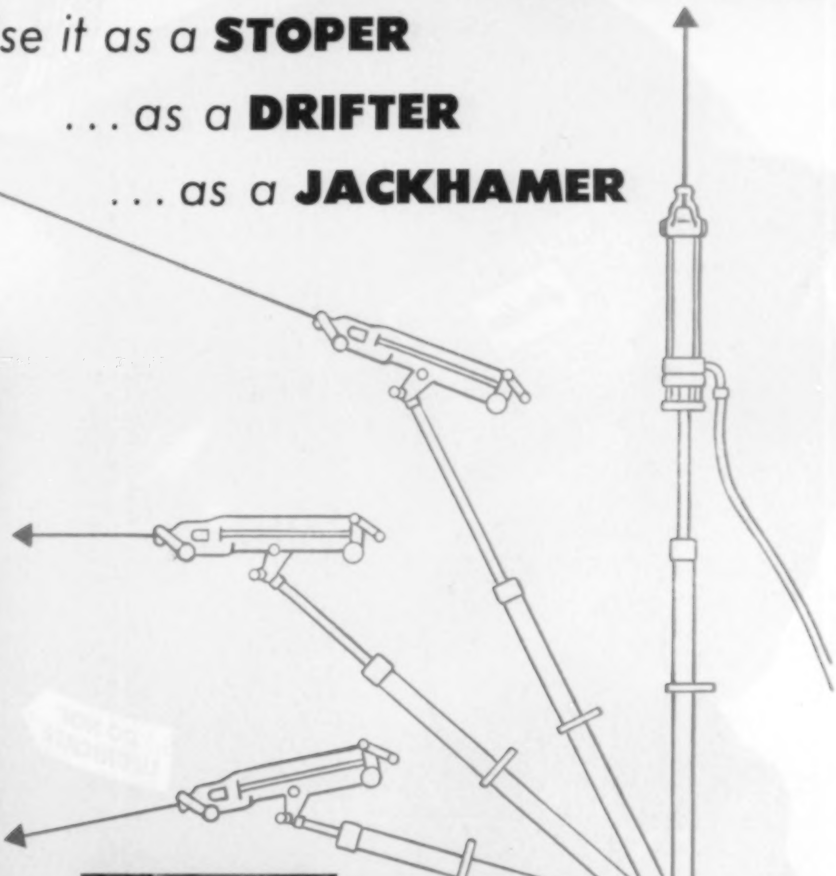
it's Ingersoll-Rand's

UNIVERSAL JACKDRILL

Use it as a **STOPER**

. . . as a **DRIFTER**

. . . as a **JACKHAMER**



The JR-38 Jackdrill is excellent as a plugger or Jackhamer. It is easily detachable from the leg by loosening one nut and ready to use without any further adjustments.

IT'S A LIGHT-WEIGHT AIR-FEED DRILLING UNIT

. . . designed for faster, easier operation in any position

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 814-5

WESTINGHOUSE
Life-Line
DO NOT LUBRICATE
WHAT Life-Lines REALLY DELIVER IS MORE SERVICE...LESS SERVICING

The way to grease modern motors is DON'T!

The modern, *pre-lubricated* Life-Line consigned greased fittings to the motor museum almost ten years ago—and did away with faulty lubrication.

Think what it means. No more incorrectly greased motors. No failures from overlubrication, from under lubrication . . . from use of incorrect or dirty grease. Correct lubrication is sealed in . . . in advance.

Result? Longer motor life. Over a half million *pre-lubricated* Life-Line motors operating in every conceivable type of application have proved that outages from incorrect lubrication have been eliminated completely.

Take the case of an eastern manufacturer, for example. Motors were installed high on a press—out of reach of a maintenance man. Consequently, motor lubrication was forgotten. Bearings failed—windings burned. Then *pre-lubricated* Life-Lines were installed. Failures disappeared. Today, motors are still forgotten—but safely.

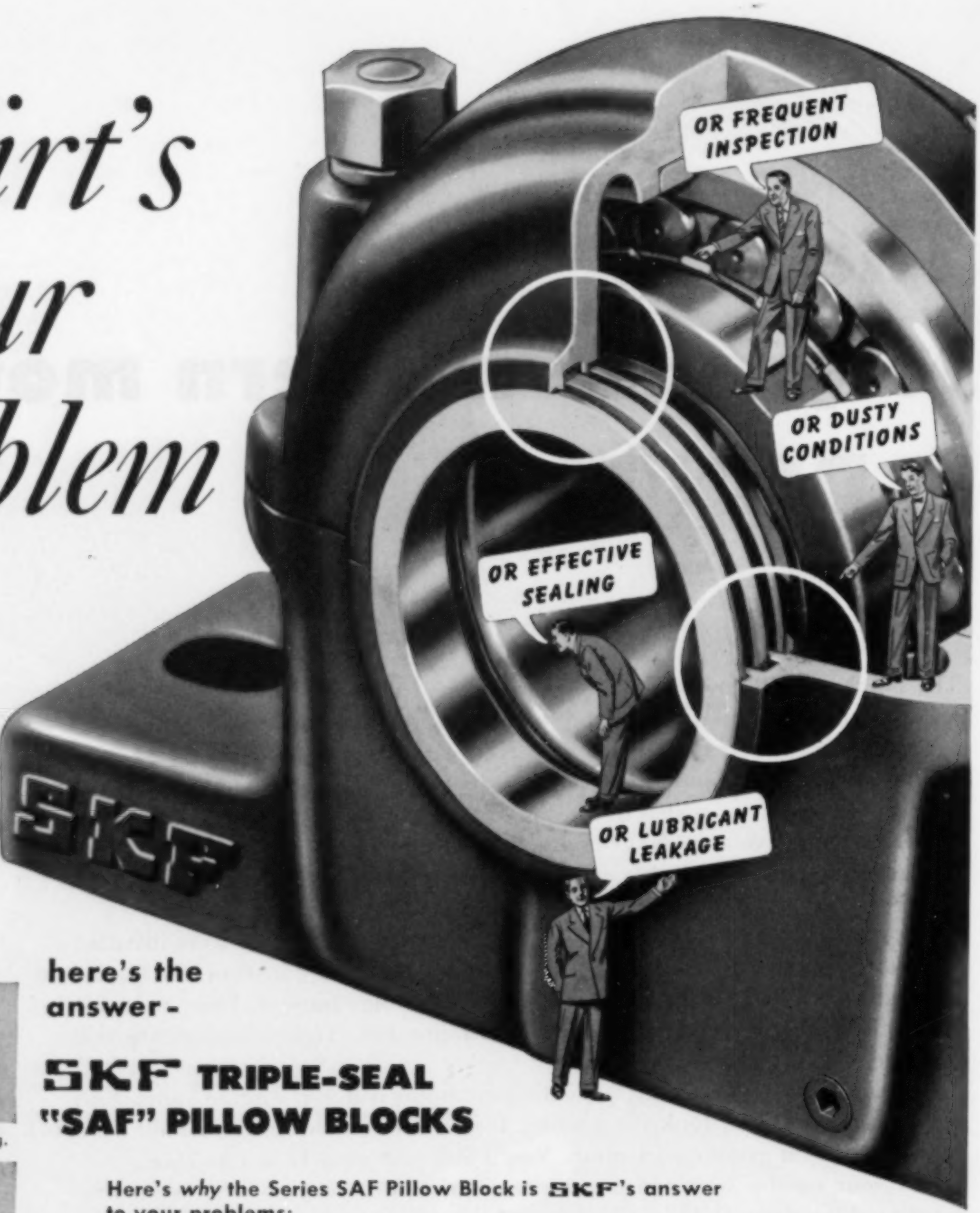
Remember, the way to lubricate a modern motor is don't. And, to spot a *truly* pre-lubricated motor, look for a motor that has *no* grease fittings. You'll *know* then it needs no greasing attention. You'll find your answer in Life-Lines.

Ask your nearby Westinghouse representative for a copy of "Facts on Pre-lubricated Bearings, B-4378", and for all the reasons why Life-Lines offer you more service on the job . . . less servicing. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21682

YOU CAN BE SURE...IF IT'S
Westinghouse

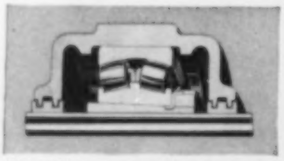
Life-Line
MOTORS and CONTROLS

If dirt's your problem

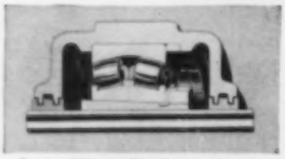


here's the answer -

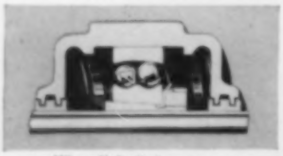
SKF TRIPLE-SEAL "SAF" PILLOW BLOCKS



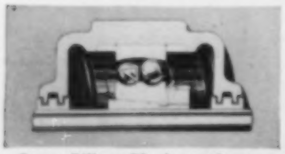
"Free" Spherical Roller Bearing.



Same Pillow Block as above, Bearing "Held" by stabilizing ring.



"Free" Ball Bearing.



Same Pillow Block as above, Bearing "Held" by stabilizing ring.

Here's *why* the Series SAF Pillow Block is SKF's answer to your problems:

- Triple-Seal rotating rings give positive protection in dirty locations; effectively seal out foreign matter; seal in oil or grease.
- Stabilizing ring between the housing shoulder and the bearing insure fixed position of one held bearing on the shaft and prevents end movement of the shaft.
- Adapter-type bearings permit use of standard shafting, yet provides a *tight fit.*
- Easy to install and inspect; self-aligning.

7471

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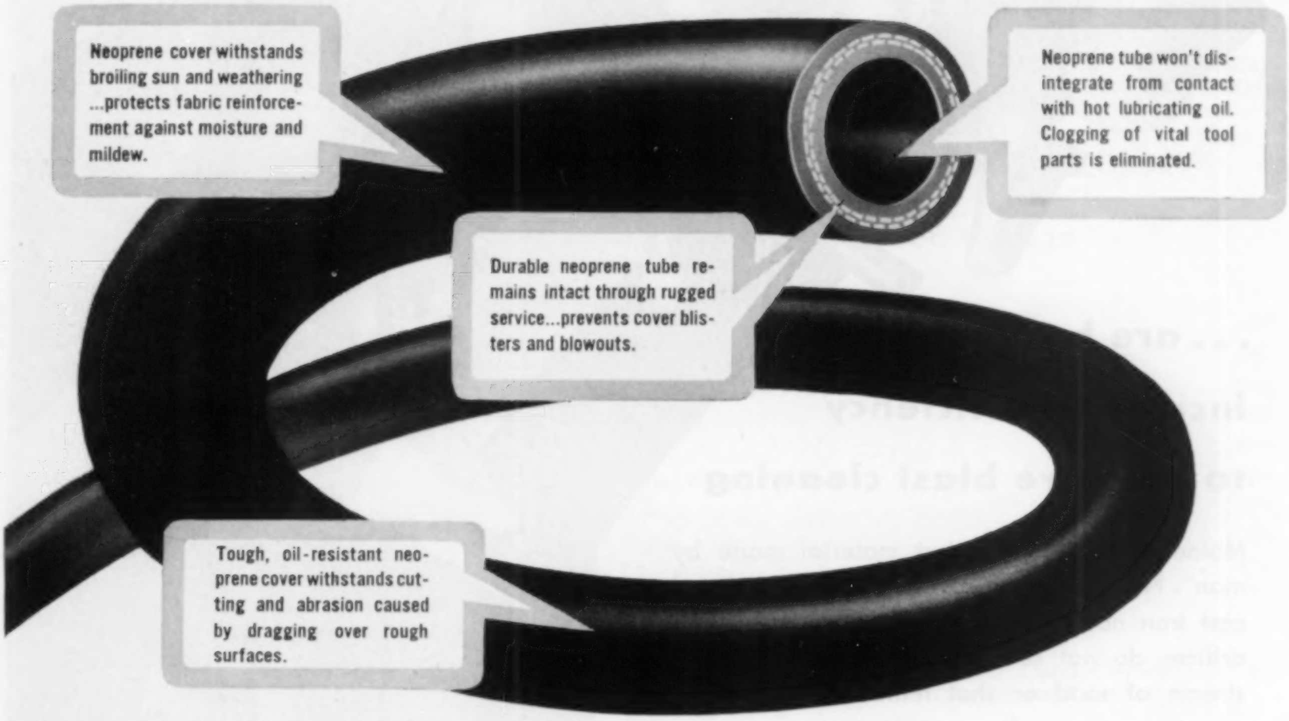

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ON THE COVER

THE finishing operations on Goodyear Vinylfilm, a thin plastic that goes into rainwear, shower-bath curtains, garment bags and the like, are performed on the calender rolls shown on our cover. The machine is claimed to be the fastest of its kind. Each of its rolls is 92 inches long, 32 inches in diameter and weighs 25,000 pounds. Through holes that are drilled longitudinally through each roll just beneath the surface, high-pressure water is circulated to maintain a roll-face temperature of 355°F.

Following the calendering, the plastic may be embossed, in which case the embossing roll is pressed against it by two 12-inch air cylinders (shown on either side at the level of the man's feet) that exert a pressure of 150 psi.

The finished material is wound on a roll that is equipped with a yardage counter. When the length for which the machine was preset has been wound, two other cylinders, not shown, operate a heated, serrated knife that cuts the material. A new roll is then started on an empty core, which replaces the filled one.

The calender was built by Adamson-United Company, Akron, Ohio.

●

NEXT MONTH

WHAT major city

- —is underlain by quarries that were worked from 50 B.C. to 1800 A.D.?
- —has a compressed air distribution system from which any household, store or industry can obtain air as easily as it does gas or electricity?
- —operated successfully for 50 years several dozen public pneumatic clocks?
- —has in its heart a depository containing the remains of six million of its citizens?
- —has two complete and separate water-distribution systems serving its entire area?

The foregoing are a few of the things about Paris that are little known. They will be covered in detail in a 2-part article, *Paris Underground*, scheduled to start in our October issue.

●

CORRECTION

IN THE article, *Gliding and Soaring*, July issue, it was stated on page 197 that "Langley . . . with his steam-engine equipped *Aerodrome* . . . flew a distance of half a mile in 1896." It is pointed out by Arthur H. Morse, of the Baldwin Company, Cincinnati, Ohio, that this is incorrect. Langley built two steam-driven *models* that flew successfully but without a passenger. His *Aerodrome*, which was intended to carry a man, was powered by a radial gasoline engine (designed by Charles Manly). A pilot failed in two attempts to launch it.

Compressed Air Magazine

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EDITORIAL CONTENTS

More Power from Hickling Station—*J. C. Pierce* 244
Compressed Air at Work 250
Aluminum Venture in British Columbia, Part 2—*H. R. Rice* 252
Standardized Plumb-Bob Points—*James Hirt* 260
Flameless Welding 261
The Statitron 262
Editorials—The Water Problem 263
This and That 264
Industrial Notes 265
Industrial Literature 271

ADVERTISING CONTENTS

Adams Co., Inc. R. P. 33
Allis-Chalmers Mfg. Co. 7
Anaconda Copper Mining Co. 32
Bethlehem Steel Company 6
CCA Division-Breco Mfg. Co. 39
Combustion Engineering-Superheater, Inc. 38
Compressed Air Magazine Co. 39
Cook Mfg. Co., Inc., C. Lee 4
Coppus Engineering Corp. 2nd cover
Crucible Steel Co. of America 28
Detroit Diesel Engine Division 37
DeZurik Shower Company 39
Dollinger Corporation 3
Donaldson Co., Inc. 25
du Pont de Nemours & Co., E. I. 17
Eimco Corporation, The 9
Elliott Company 41
Fluor Corporation, Ltd., The 11
Galland-Henning Mfg. Co. 43
General Electric Co. 30, 31
Goodall Rubber Company 40
Goodrich Company, The B. F. 27
Hansen Manufacturing Co., The 35
Hercules Powder Company 36
Hose Accessories Company 23
Industrial Clutch Corporation 40
Ingersoll-Rand Company 5, 12, 13, 3rd cover
Logan Engineering Co. 43
Manhattan Rubber Division 10
Maxim Silencer Co., The 22
Naylor Pipe Co. 24
New Jersey Meter Company 42
Norgren Co., C. A. 43
Norton Company 18
Raybestos-Manhattan, Inc. 10
Sarco Company, Inc. 42
Sauerman Bros., Inc. 20
Schraders' Son, A. 29
SKF Industries, Inc. 16
Square D Company 42
Texas Co., The Back Cover
Timken Roller Bearing Co., The 44
Toledo Pipe Threading Machine Co., The 8
Victaulic Company of America 21
Vogt Machine Company, Henry 34
Walworth Company 26
Westinghouse Electric Corp. 14, 15
Wisconsin Motor Corporation 19

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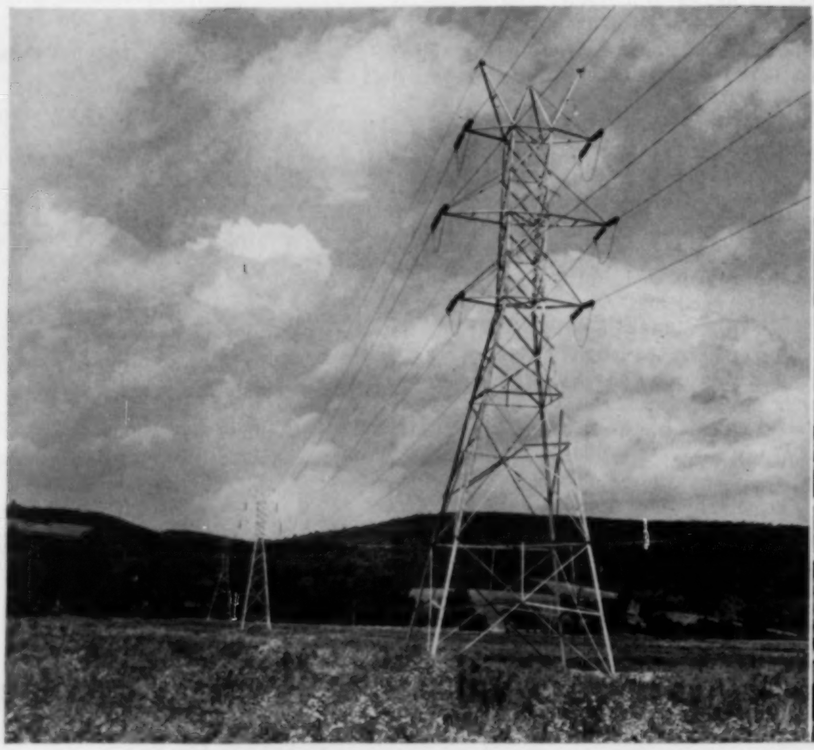
More Power from Hickling Station

Century-old New York State Utility Adds 50,000-kilowatt Generator to Its Expansive Electrical Network

J. C. Pierce

HICKLING STATION
NAMED AS A MEMORIAL TO
WILLIAM G HICKLING
1897 – 1947
VICE PRESIDENT AND GENERAL MANAGER OF THIS CORPORATION
WHOSE ENGINEERING VISION AND INGENUITY
CONTRIBUTED SO MUCH TO
THE FURTHER DEVELOPMENT OF LOW COST POWER
FOR THIS REGION
NEW YORK STATE
ELECTRIC & GAS CORPORATION
1948

DEDICATION PLAQUE



SPEEDING KILOWATTS TO MARKET

Hundreds of miles of transmission lines are required to deliver power throughout the 16,700 square miles in 43 New York counties that the system serves. The territory contains 1,400,000 people and is predominately rural.

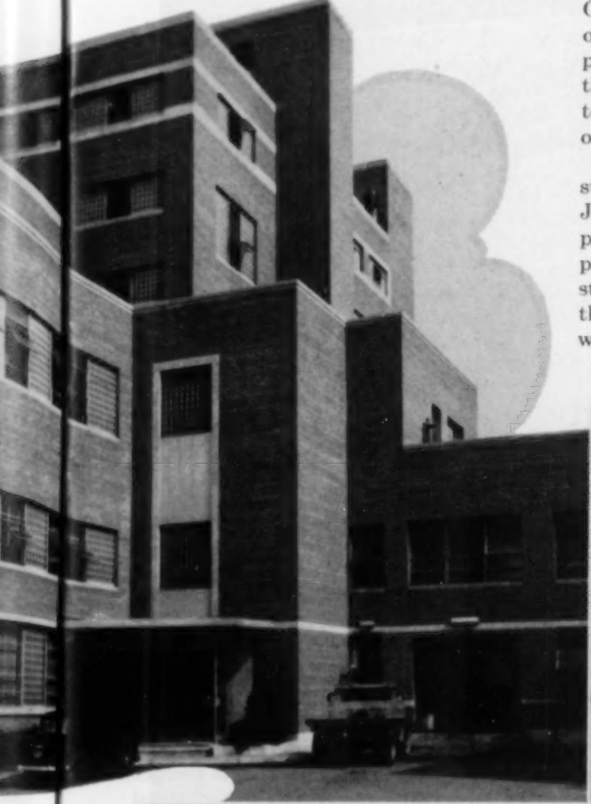
THE public utility electric companies have unusual marketing problems. Their product cannot be stored against future orders, yet must be available when wanted. Moreover, there must always be enough surplus producing capacity to satisfy any sudden abnormal demand and to take care of new customers without delay. Because people rely heavily on electricity in their homes, stores and industries, the power companies shoulder a large responsibility. To meet it they call upon the best engineering talent and equipment to be had and strive ever to build not only for the present but also for a reasonable period in the future. Thomas A. Edison would be pleased if he could see what has grown out of the first central station he established in 1882 on Pearl Street in New York City to light the electric arc and carbon-filament incandescent lamps of the neighborhood. He would marvel at modern central stations such as Hickling Station.

Hickling is one of five steam generating plants owned and operated by the New York State Electric and Gas Corporation, which also maintains six hydroelectric plants. It is situated just outside of East Corning, N.Y., on a spot on the Chemung River where General Timothy Pickering negotiated an important treaty with Iroquois Indian chiefs in 1791. The station's first generator, a 30,000-kw unit, began in October of 1948 delivering 13,800-volt current to an adjacent substation where it was stepped up to 33,000 and 114,000 volts and fed into transmission lines. Shortly afterward the generator was speeded up to its capacity rating of 35,000 kw and the station maintained that output until upon the completion of a recent expansion program, it was provided with a new 50,000-kw unit to meet the growing needs of the territory served. This additional generator went on the line on June 6 of this year, three months ahead of schedule. Gilbert Associates, Inc., of Reading, Pa., designed the plant. The original construction was handled by Sordoni Construction Company, of Forty Fort, Pa., and the new section was erected by C. D. Murray Company, of Syracuse, N.Y.

The New York State Electric and Gas Corporation is one of the nation's older utility concerns, having been in business an even hundred years. Consequently, all the miracles of modern electrical engineering have taken place within the span of its corporate existence. As the Ithaca Gas Light Company, with a capitalization of $75,000, it began, in 1852, making illuminating gas from coal in iron retorts. Inspired by the success of Edison's incandescent lamp, the company turned to the new lighting source and provided its first electric service in the early 1880's. It furnished current for one of the first rural applications of electricity on the farm of L.C. Pyser who, in 1891, installed lighting in his poultry houses to promote egg production—a practice usually considered to be a strictly modern innovation.

Numerous consolidations and expansions through the years have brought the company its present name and a service territory of some 16,700 square miles spread over 43 counties of New York State—about 35 percent of the state's land area. Its capital investment in property, plant and equipment and including its gas facilities now stands at $201,865,000. It serves some 1,400,000 people, about 70 percent of whom live outside city limits. This population is stable, deriving its livelihood principally from diversified industries and some 48,500 farms.

The addition to Hickling Station is but one of several system construction projects recently completed or now underway. All are included in a program under which $76,000,000 will be expended during the years 1952 to 1955, with the greatest portion going to increase the



UNUSUAL STATION VIEW
As seen from this angle (below), the station might pass for a manufacturing plant and that conception is not far wrong, as it is essentially a factory that turns out an invisible but highly necessary product.

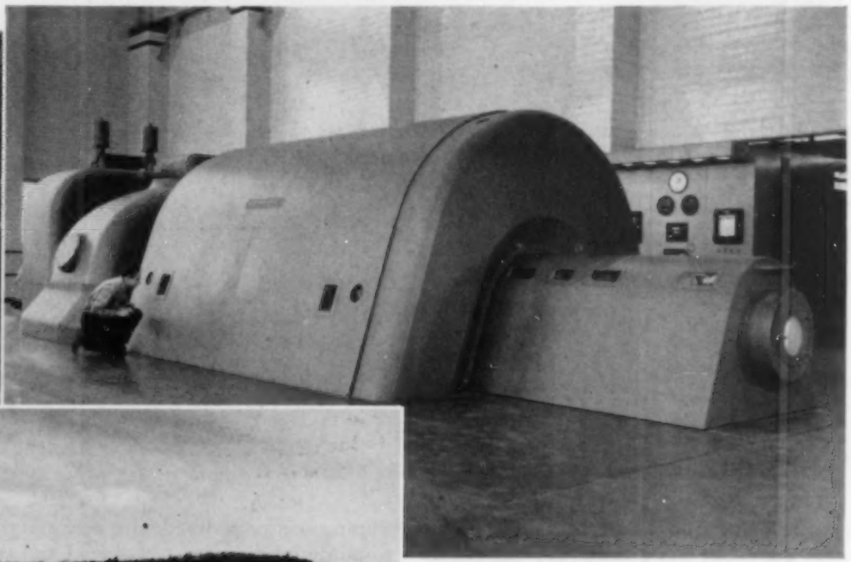
steam-generating facilities. On December 26, 1951, a 75,000-kw addition to the Goudey Station near Binghamton brought that plant's capacity up to 174,000 kw. Started in November, 1951, and scheduled for completion in late 1953 is a 100,000-kw addition to the Greenidge 92,000-kw station at Dresden, on Seneca Lake. Total generating capacity in this "central area" is now more than 400,000 kw, and it will be increased to above 500,000 kw at the completion of the program.

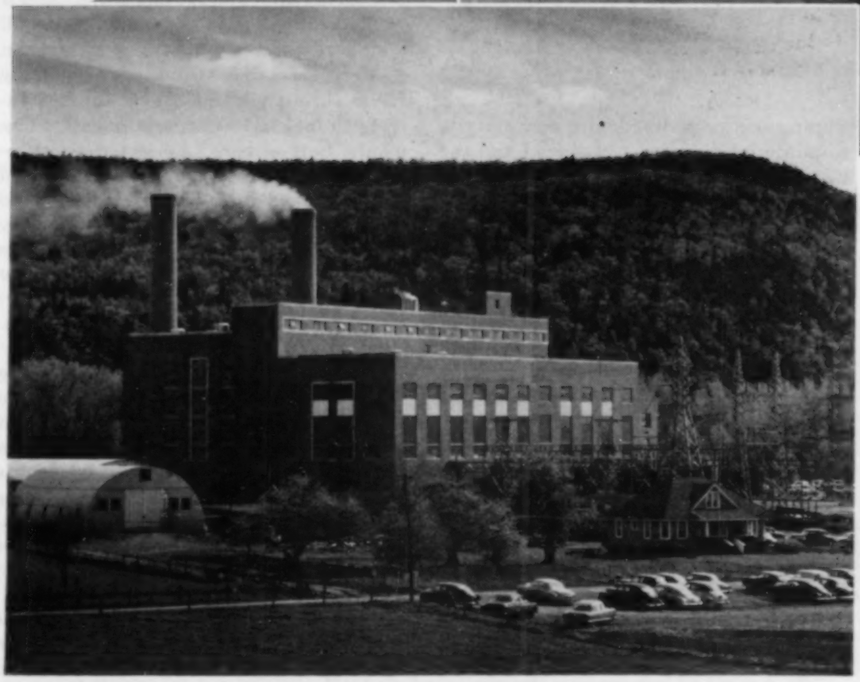
Of the four other steam generating stations in the company's network, the Jennison Station at Bainbridge, completed two years before Hickling, is the prototype for the original Hickling installation. The main difference between the two as they were initially operated was the higher steam operating pressure of 850 psig and temperature of 900°F at Hickling as compared with Jennison's 650 psig and 825°F. The increases put into effect at Hickling were designed to offset the rising cost of fuel and they made Hickling the lowest-cost steam generating plant in the system.

Like all central stations, Hickling is a factory into which pour great quantities of raw materials by train, truck and conduit; where millions of dollars worth of equipment hum under the supervision of trained technicians, and from which emerges a single invisible salable product that goes to market over a network of solid wires. Those characteristics lend emphasis to the fascination of the production of electricity and to the mysteries of electricity itself.

The principal raw materials are, of course, fuel and water. As Hickling is located near the anthracite coal region of Pennsylvania it was logical to choose that fuel. When operating at its full 85,000-kw capacity, the plant requires about fourteen carloads, 800 tons, daily of No. 4 buckwheat size, and the handling of this material from dumping hopper to ash disposal is a model of mechanical efficiency.

Unruly weather cannot be allowed to jeopardize the smooth operation of such plants and consequently a great deal of attention is paid during design and construction to providing adequate protection against the elements. So that the flow of fuel to Hickling's boilers can be handled under any weather conditions a track hopper house that accommodates four railroad cars at a time was built. The dumping hopper will hold the contents of an entire car. From ample yard trackage off the Erie Railroad spur that serves the plant, cars are shuttled in for dumping by a plant-owned 18-ton Plymouth locomotive powered by a six-cylinder Buda gasoline engine. Facilities





HICKLING STATION
One of five steam-powered generating plants operated by New York State Electric & Gas Corporation in the central area of its system. Originally of 35,000-kw capacity, it has recently received a new 50,000-kw generator and the requisite accessory equipment. The initial turbine generator, which runs at 3600 rpm, is pictured at the upper right.

COAL PILE AND STOKERS

The fuel is No. 4 buckwheat size anthracite coal—of about the same consistency as coarse-ground coffee. About 800 tons is burned daily, arriving in railroad cars that are dumped directly into the plant handling system. A huge reserve pile adjacent to the station receives its supply by diversion of any surplus from inside the station. The coal is distributed over the stockpile area by an Allis-Chalmers bulldozer (right). The fuel is efficiently burned in four traveling-grate stokers. The charging ends of two of them are pictured below. Stainless-steel-lined chutes feed the fuel from overhead bunkers. The sectionalized baffle plates between the chute bottoms and the grates conceal the fury of the flames as they are fanned by 290-degree air from a high-capacity fan.

for thawing frozen coal in the cars and a car shakeout mechanism are provided.

From the hopper, coal is handled by 100-ton-per-hour Link-Belt conveying equipment beginning with four reciprocating feeders that draw it from the hopper onto an inclined belt conveyor equipped with a Merrick Scale Manufacturing Company Weightometer. A chute from the coal storage facilities in the yard, where some 70,000 tons are normally kept in reserve, also discharges onto this belt so that the fuel can be weighed into the plant during reclaiming operations. This weighing conveyor discharges into a bucket elevator at the head of which coal can be diverted to the storage yard, or continue onto a second inclined belt that discharges into an 18-inch Link-Belt screw conveyor, which distributes it to four 350-ton bunkers. All conveyor belts are 24-inches wide, and are operated at 200 feet per minute by General Electric motors.

The reinforced concrete bunkers have vertical sides with the exception of the rear one, which slopes 50 degrees toward the discharge chutes from a point about two-thirds down from the top. This sloping section is lined with ceramic tile to minimize abrasion to the coal and the hopper and to present a free-flowing discharge surface. The fuel flows by gravity from the bunkers to the stoker hoppers through stainless steel lined chutes that are being replaced when necessary by Gates Rubber Company steel chutes lined with a ⅜-inch thickness of rubber.

The traveling grate stokers are said to be the largest in the utilities field. Each of the two original units is 24 by 28 feet and weighs 125 tons, while the new units are 26½ by 28 feet, with an effective grate area of 742 square feet. All are of the Lloyd type made by Combustion Engineering-Superheater Inc. The normal coal bed on the grates is 3½ to 4 inches deep. The grates, made up of thousands of thin cast iron keys dovetailed to cast iron grate bars, are equipped with variable speed drives that can vary the rate of travel from 0 to 90 feet per hour. Nine separate compartment dampers under the fuel bed can be manually controlled to vary the draft condition. Ashes drop continuously from the discharge end of the stoker into a flooded pit. A grid on the refractory-lined pit outlet breaks up clinkers and the ash-water mixture is removed by a United Conveyor Corporation hydraulic jet to a settling basin, where a local cinder-block manufacturer takes over the product. The ash handled is about 12 percent of the coal by weight and approximately 96 tons are discarded daily.

The huge volume of water required for steam generation, steam condensing, machine cooling and other usages is a major consideration. The cooling water, about 75,000,000 gallons daily—enough to fill a 20-acre pond to a depth of more than 11 feet—is taken from the Chemung River through a trash rack, into a concrete tunnel, over either of two traveling Chain Belt screens, subjected to automatic intermittent chlorination and thence picked up by six Ingersoll-Rand circulating pumps varying in capacity from 4,380 to 10,200 gpm. These pumps deliver it to the circulating-water header from which it goes to the condensing, hydrogen-cooling, screen-washing, ash-sluicing and house-service systems.

Two deep wells within the building foundations furnish make up water to the steam system in a volume equivalent to about 1 percent or the total steam generated. After it is treated by zeolite softeners to remove all scale-forming salts, it is pumped to an American Locomotive Company evaporator, which is equipped with a heater and deaerator. From the evaporator the distillate is admitted to the feed-water circuit of the steam system as a vapor. A 12,000-gallon and a 20,000-gallon tank full of treated feed water are kept in readiness to be pumped into the boiler-feed system in the event of an emergency—such as boiler tube failure.

The role of the chemical laboratory in power generating plants usually goes practically unnoticed, yet it is of vital importance to the operations and deserves recognition. It is the laboratory's function to know when the water isn't exactly right for a given application. It is the laboratory's responsibility to detect in their early stages such things as an undue build-up of organic growth in a condenser, the plugging up of an evaporator by salt-forming scale or unsanitary and unhealthy drinking water.

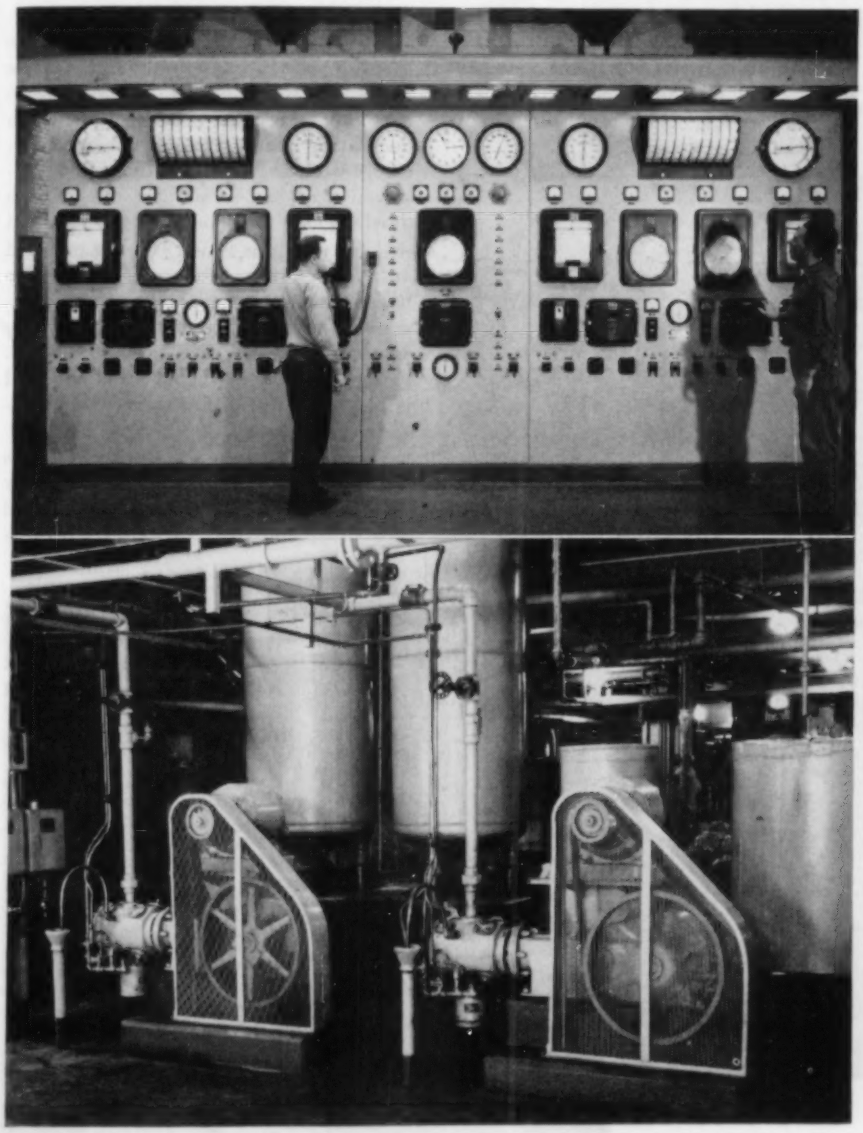
Analyzed daily are samples of river water, well water, softened water, evaporator water, evaporator salines, evaporator distillate, boiler-feed water, boiler salines, boiler saturated steam, condensate, condensate returns, feed-water storage and circulating water. The analyses include determination of one or more of the following: pH (hydrogen ion concentration ratio which tells the relative acidity and alkalinity), hardness, turbidity, chlorides, sulphite, phosphate, sulphate, iron, silica, oxygen, carbon dioxide, ammonia, conductivity, and chlorine residual.

The laboratory personnel regulate and supervise all water treatment operations. In addition, they take, prepare and analyze for moisture percent a daily sample of all coal burned. From these samples a weekly composite is prepared for the main laboratory of Gilbert Associates, consultants, where it is further analyzed. They take daily samples of the ash from each boiler for a similar composite for the central laboratory. They inspect all equipment taken from service, checking it for corrosion, erosion and deposition. Samples are taken from any deposits found and sent to the central laboratory. These technicians also conduct any special investigations that may be requested such as water system iron pickup, rate of deposition of foreign material in heat exchangers, efficiency of gas removal equipment, etc.

Now let us combine the fuel and water to make each hour the 750,000 pounds of steam required to produce the 85,000-kw of electric energy. The stokers already described are under the two original 175,000 pounds-per-hour steam generators (boilers) made by Combustion Engineering-Superheater, Inc. and two new 220,000 pounds-per-hour units, of Babcock & Wilcox manufacture. The boilers are massive 2-drum units, some six stories in height, that are constructed to operate safely at a pressure well above the 900-psi operating rating. They and their accessory equipment are designed to produce the maximum of steam energy per unit of energy input—the ultimate in sound combustion engineering.

As the burning coal bed on the stoker grates is fanned by air preheated to about 290°F and forced up through it by fans with adjustable pitch vanes, the hot gases carry some unburned and partially burned coal particles upward. This material is trapped in Western Precipitation Corporation "precipitators" at a point ahead of equipment to which its abrasive action would be damaging. The precipitators gather this unconsumed fuel for its return, together with the stoker siftings, to the coal bed for complete combustion. Above the precipitators in the blast of hot flue gases are the air preheaters mentioned before and the economizer. This latter unit is a group of tubes in which the water that will be converted to steam is preheated to about 425°F prior to its delivery to the main steam generating banks and thence to the boiler superheaters where it becomes steam at 910°F and 900 psi pressure. Now the gases that have been cleaned of entrained energy particles and that have imparted their heat energy to the boiler tubes and auxiliary equipment are drawn by induced-draft fans through the boilers and heat traps from which point they are delivered to the 150-foot-high stacks and discharged into the atmosphere at about 300°F.

Steam enters the turbines from nozzles at a speed of about 2000 miles per hour to spin the turbine shafts that drive the generators and make the electricity. Hickling Station's original turbine-generator consists of a Westinghouse 29-stage-turbine direct-connected to a 30-000-kw hydrogen-cooled generator. The newer turbine generator is a General Electric 50,000-kw unit operating under the same conditions as the other one.



INSTRUMENTATION

One of the instrument boards (top) that tell at a glance how various components of the station are functioning. Many of the instruments are operated by air and it is important that the fluid contain no slugs of moisture or oil that might clog the small delivery lines or minute openings in the instruments. For this reason, the air is compressed by machines (above) that have carbon piston rings, which require no lubrication. They are Ingersoll-Rand NL (non-lubricated) units of the ER belt-driven class. Another I-R compressor, of 304-cfm capacity, supplies air at 100 psi for general purposes such as operating pneumatic tools used in maintenance work.

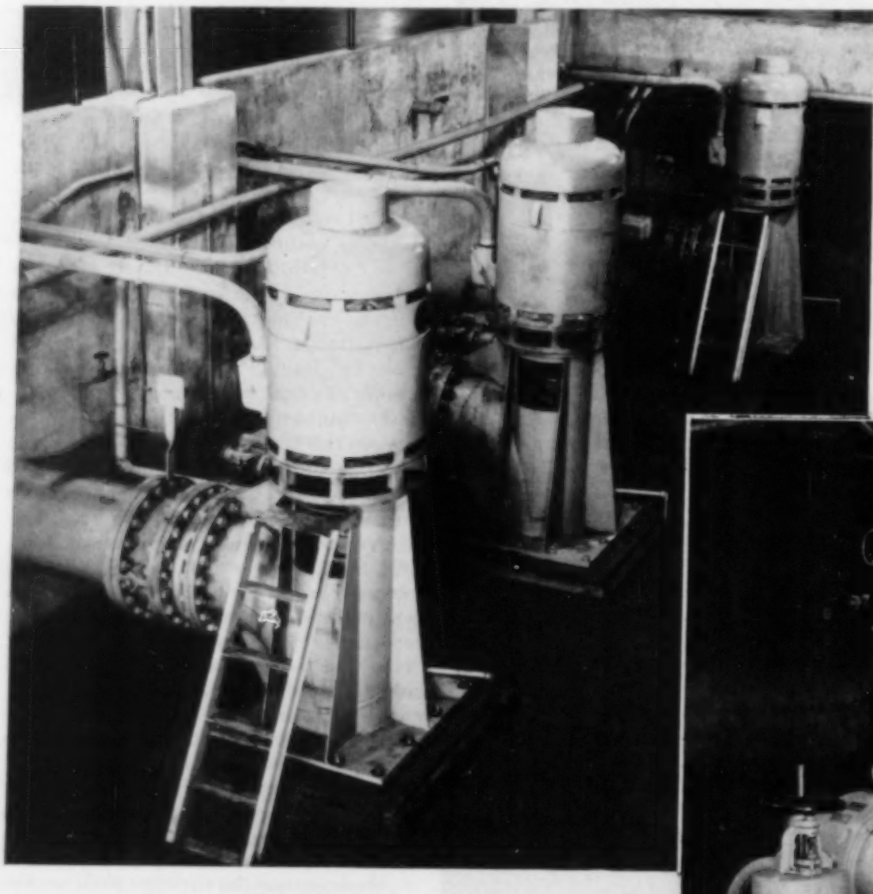
Hydrogen instead of air is used as the medium in which to operate the 3600 rpm generators for the following reasons: It is lighter than air and thereby offers less resistence to the rotating element —incidentally, this quality decreases the noise made by the generators; it has higher thermal conductivity and heat transfer coefficients and thereby cools the generator faster; it tends to reduce maintenance expense because of the absence of dirt and moisture in the sealed hydrogen circuit; and it increases the life of insulation on the generator stator winding because of the absence of moisture and oxygen. It is non-combustible when free of air and the small amount of leakage is compensated for by additions from steel cylinders kept in storage. The pressure is automatically limited to 15 psi and the gas is cooled by circulating cold water through coils built into the generator frame. To increase the advantages of hydrogen cooling, Hickling is currently preparing to carry 30 psi pressure in the hydrogen systems.

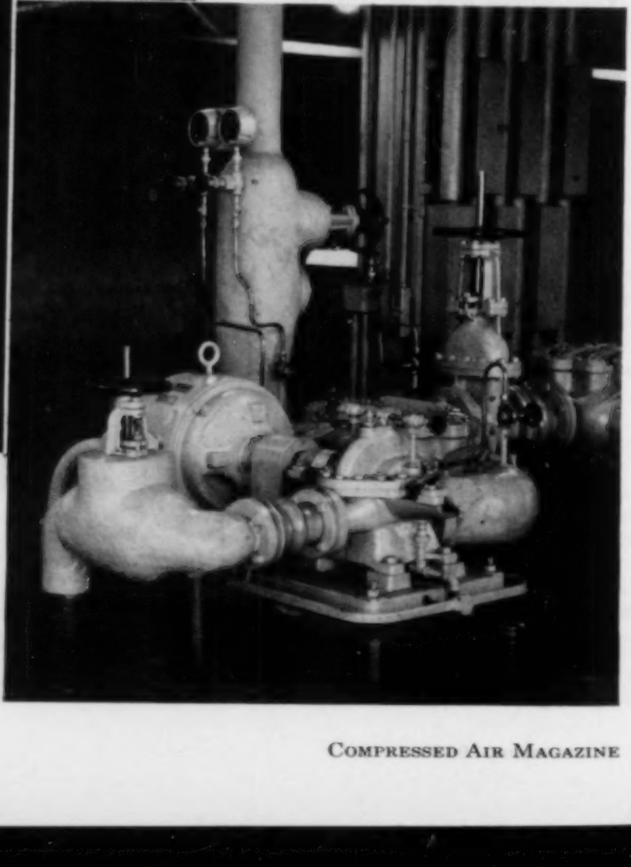
One of the more critical parts of a steam generating plant is its condensing system. Efficient condensing conserves energy and furthers economical plant operation. The steam blast that is nozzled into the turbine rapidly spends most of its energy against the hundreds of turbine blades, but it is not discarded at this point as in early-day practice. Although its heat, pressure and velocity energy are greatly dissipated, it is a purified, valuable product that is saved for reuse. But before it again can be reconverted to the 900°F, 900-psi force needed to spin the turbine and generator shafts it must be restored to the liquid form. This is the job of surface condensers.

The condensers at Hickling are twin-heart type Ingersoll-Rand Company units set immediately under the turbines. Each unit is in reality two condensers side by side and acting in unison. This design is sometimes chosen where conservation of headroom and, consequently, conservation of building materials are factors. Other distinct advantages of this type condenser are that one side can be shut down at a time for inspection, maintenance or repair, and the two halves can be shipped completely assembled thereby eliminating much field assembling.

The first condenser installed at Hickling contains 26½ miles of ¾-inch tubes having a surface area of 27,500 square feet exposed to steam contact. Through these tubes the cool river water is circulated and around them flows the spent steam to be condensed into 90°F water. The second condenser is considerably larger, having 42,500 square feet of tube surface. The condensate drops from the tubes into hot wells below the tube sections and from there it passes to Ingersoll-Rand 500-gpm condensate pumps that force it through feedwater heaters where live steam brings its temperature up to about 180°F. It is then piped to a deaerating heater where it is heated further by steam and this drives off dissolved oxygen, ammonia and carbon dioxide gases. At this point the required make up water is added and it is pumped at 1000 pounds pressure by 600-gpm boiler-feed pumps through a high-pressure heater where more turbine steam raises the temperature to about 350°F. From there it goes to the economizer and is then back in the circuit previously described.

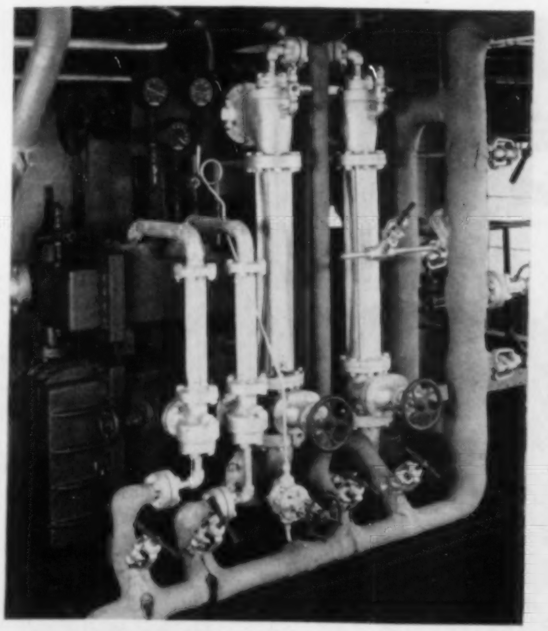
In any plant there will be some failures of mechanical equipment. To enjoy maximum insurance of an uninterrupted flow of 13,800-volt current from Hick-

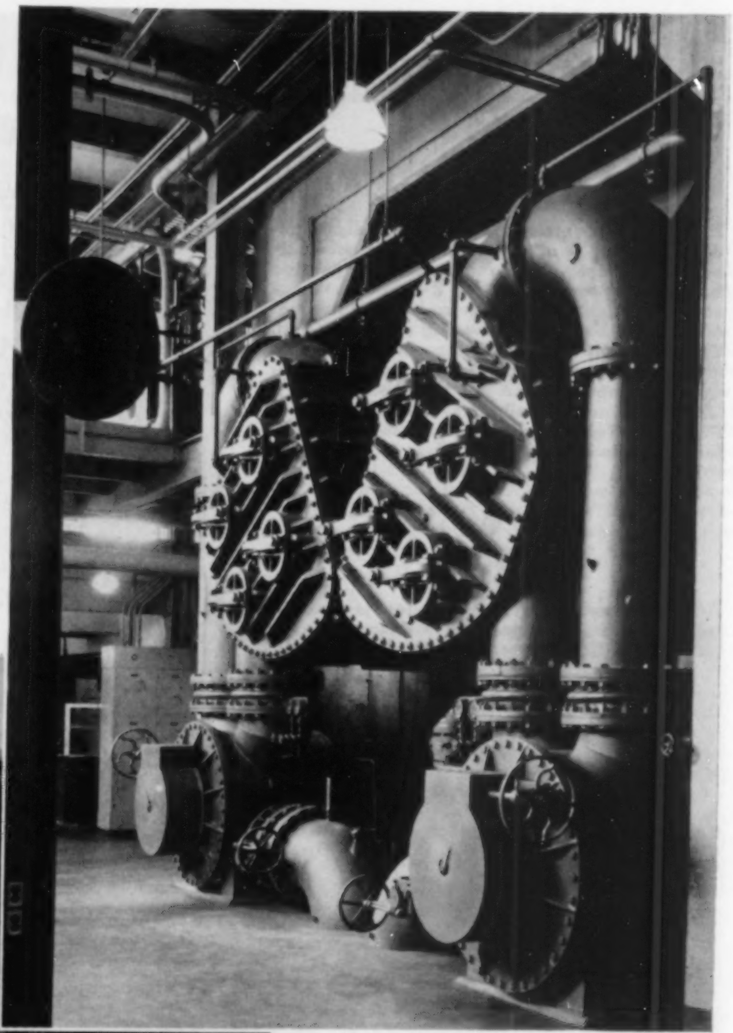


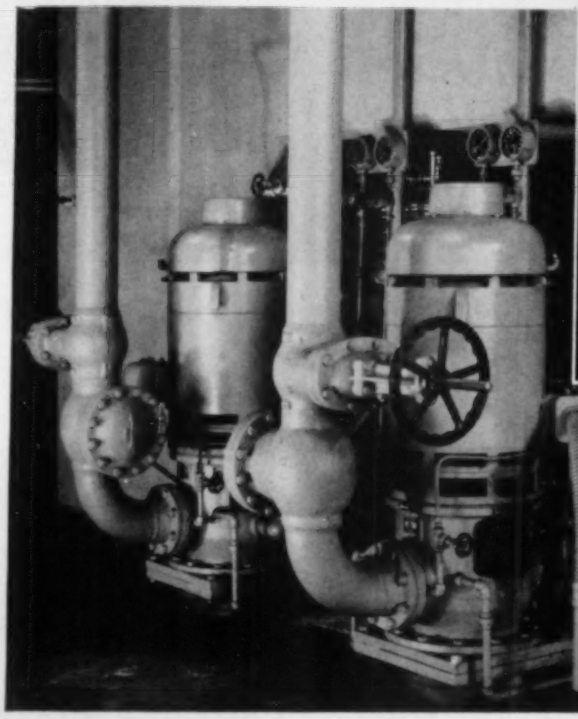


WATER PUMPS

Above are shown three of six Ingersoll-Rand vertical pumps that each day send about 75 million gallons of Chemung River water into the station for condenser cooling service and general plant purposes. The water is taken from the stream through a trash rack and traveling screens that catch driftwood and other unwanted objects. The two screens are side by side and while one side is in service the other is cleaned by water directed at it from the back through a group of nozzles. The water is delivered under pressure by the I-R pump shown at the right.







STEAM CONDENSERS

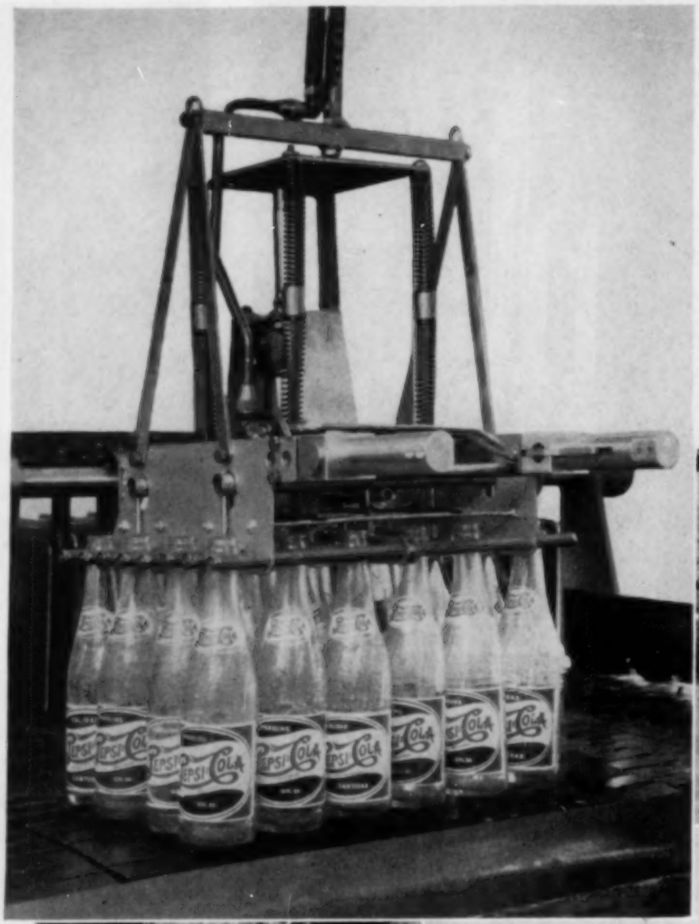
After its force has been expended against the hundreds of blades in a whirring turbine, the steam is converted to water in an Ingersoll-Rand condenser, one of which is located directly under each generating unit. The heart-shaped ends of the twin sections of the smallest of the condensers are shown above with its large-section connecting piping. Within the condenser, river water circulates through 26 miles of tubes having an aggregate exterior surface area of 27,500 square feet, while the steam is directed across the nest of piping and is consequently suddenly cooled. Entrained air and other gases are removed and a vacuum of 28 inches of mercury maintained within the twin condenser shells by the action of I-R 2-stage steam-jet ejectors (top-left). The condensate is returned to the boiler feed water circuit for reuse by one of the two I-R 500-gpm pumps pictured at the left.

ling's generators all operating equipment is protected against stoppage or faulty operation by every conceivable means. Electronic devices guide automatic controls, sound alarms when abnormal conditions exist, record operating variations that may precede trouble. Gauges, meters, instrument panels serving various units and groups of equipment are always within the sight of attendants. Duplicate standby equipment is ready to take over failures at strategic points. Auxiliary electric circuits lead to vital machines. Operators in the control room keep their fingers on the pulse of the plant and the transmission line. In front of them instrument bedecked control panels register all fluctuations and disturbances. An adequately equipped and staffed mechanical and electrical shop affords means of making quick repairs and adjustments to much of the equipment.

The safety and welfare of the workers is paramount at Hickling and is reflected throughout the plant. Good housekeeping, a prerequisite to safe and pleasant working conditions, is the watchword. Elevators, paging systems, the best of lighting, ventilating and heating systems add to the convenierces and comfort of all of the 65 employees. These features that may outwardly appear trivial and irrelevant to the function of generating electricity, are essential factors in the operation of a successful power plant.

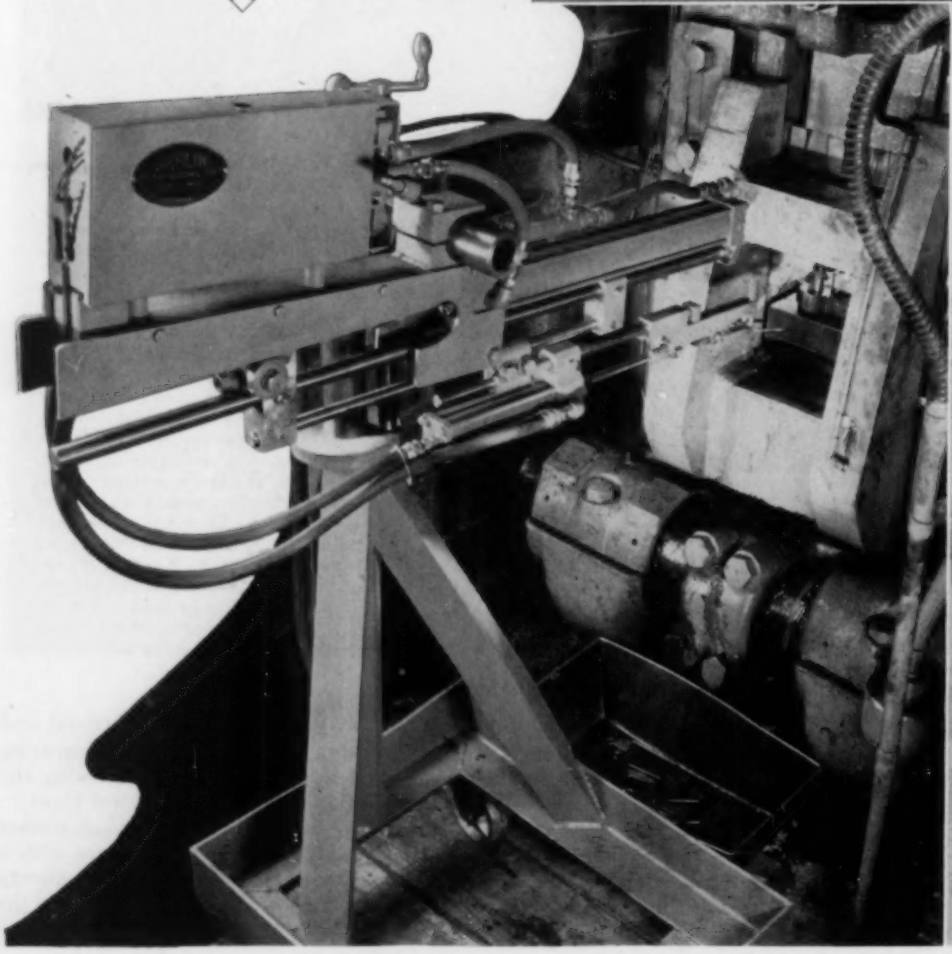
They are indispensable to a station that will provide its customers with a dependable supply of electrical energy and a high standard of service at the lowest possible price.

Ingeniously contrived machinery helps soft-drink makers continue to sell their products at a low price. Pictured is an air-operated bottle gripper depositing 24 bottles on a soaker feed table after having lifted them out of a case riding on a traveling conveyor belt. The gripping mechanism is actuated by an air cylinder, and the lifting is done by another cylinder mounted on an overhead trolley. The machine is made by Standard-Knapp, Portland, Conn., a division of Emhart Manufacturing Company.

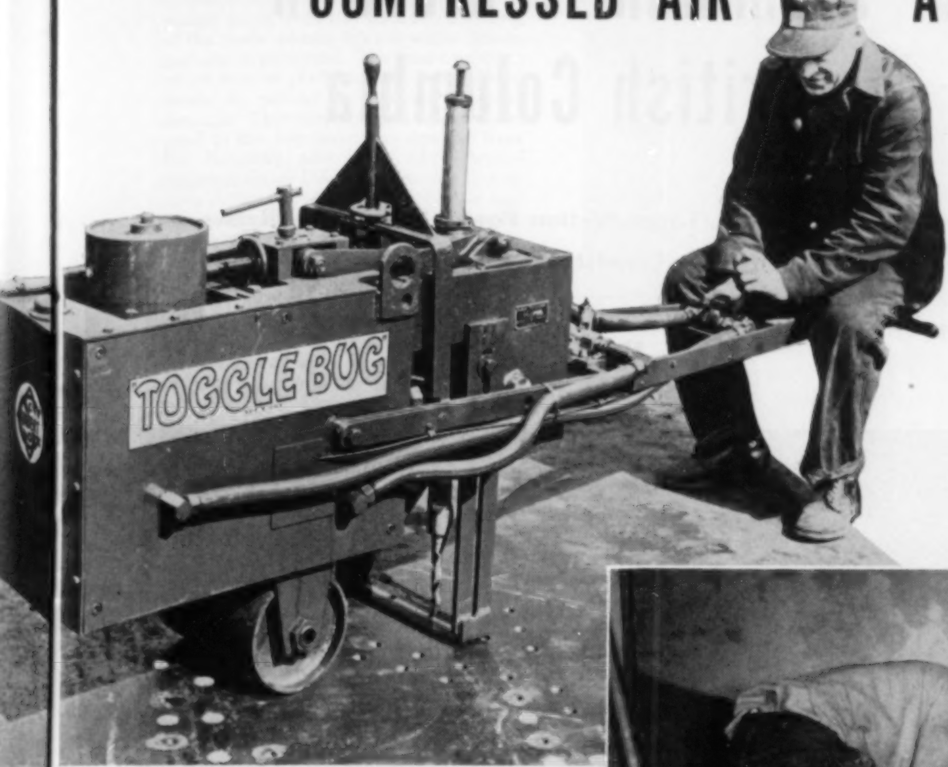


◆

Actuated by an air cylinder, a steel jaw moves into the die of a metal press, grasps the part just stamped or sheared, retracts and deposits it in a tote box. The automatic mechanical unloader is mounted on a heavy steel frame that rides on caster-type wheels and can be moved about, if desired, from one press to another. Gripping jaws of various designs are provided for differing conditions. Jaw, air cylinder and electric controls are the same as those used on stationary Iron Hands produced by the same manufacturer, Sahlin Engineering Company, 267 Ferndale Street, Birmingham, Mich.



COMPRESSED AIR AT WORK



⇦ The Toggle Bug shown is used by Liphart Steel Company, of Richmond, Va., for drilling, reaming and countersinking holes up to 2¼ inches in diameter. This model of the handy, mobile units made by Guibert Steel Company, Pittsburgh, Pa., uses an Ingersoll-Rand 8.6-hp air motor to drive the tool. The speed can be varied as desired by either throttling or regulating the air pressure. Other advantages of an air motor in such an application are that it can't be damaged or burned out by overloading or stalling, and there is no possibility of short circuits or fires. Moreover, an air motor is economical to maintain and has a long service life.

⇧

In the Baldwin-Lima-Hamilton Corporation shops at Eddystone, Pa., fumes and sparks from welding operations are removed by more than 100 portable Lamb Air-Movers made by Mine Safety Appliances Company. When compressed air from a shop line is expanded at high velocity by passing through the annular orifice and outlet horn of one of these units, it draws along with it and away from the worker's breathing zone the atmospheric air within its reach. An Air-Mover weighing only 5 pounds and but 3 feet long will exhaust more than 4 cubic feet of air per second when supplied with compressed air at 20 psi pressure.

●

FLAMMABLE
GAS
INFLAMMABLE
F-OIL

⇦ For the purpose of field servicing equipment used by contractors, strippers of overburden from coal seams and the like, The Cypher Company, of Pittsburgh, Pa., builds the truck shown here. It carries lubricants suitable for air compressors, power shovels, Tournapulls, trucks and other machines, as well as water, gasoline and other necessities. Mounted on a 20x63-inch air receiver near the rear is an Ingersoll-Rand 5-hp gasoline engine-driven compressor that supplies air at pressures up to 200 psi for operating lubricating equipment and inflating tires. The trucks have proved so popular that the manufacturer has outfitted a new plant in which to build them.

Aluminum Venture in British Columbia

Driving Ten-Mile, Large-Section Power Tunnel and Raises for Penstocks Constitutes Huge Drilling Job

H. R. Rice

Part 2

Power Tunnels

FOR delivery of water from the intake works at the west end of Tahtsa Lake to the turbines in the underground generating station at Kemano there will ultimately be two horseshoe-shaped tunnels with concrete inverts. Each will be 25 feet in diameter, 10.1 miles long and spaced 300 or more feet apart. An accompanying drawing shows these bores in plan and profile and gives pertinent information on elevations and slopes from the intake works to the tailrace at the Kemano River. No. 1, the more northerly, is now being driven, and the second one is to be undertaken whenever power demands warrant it.

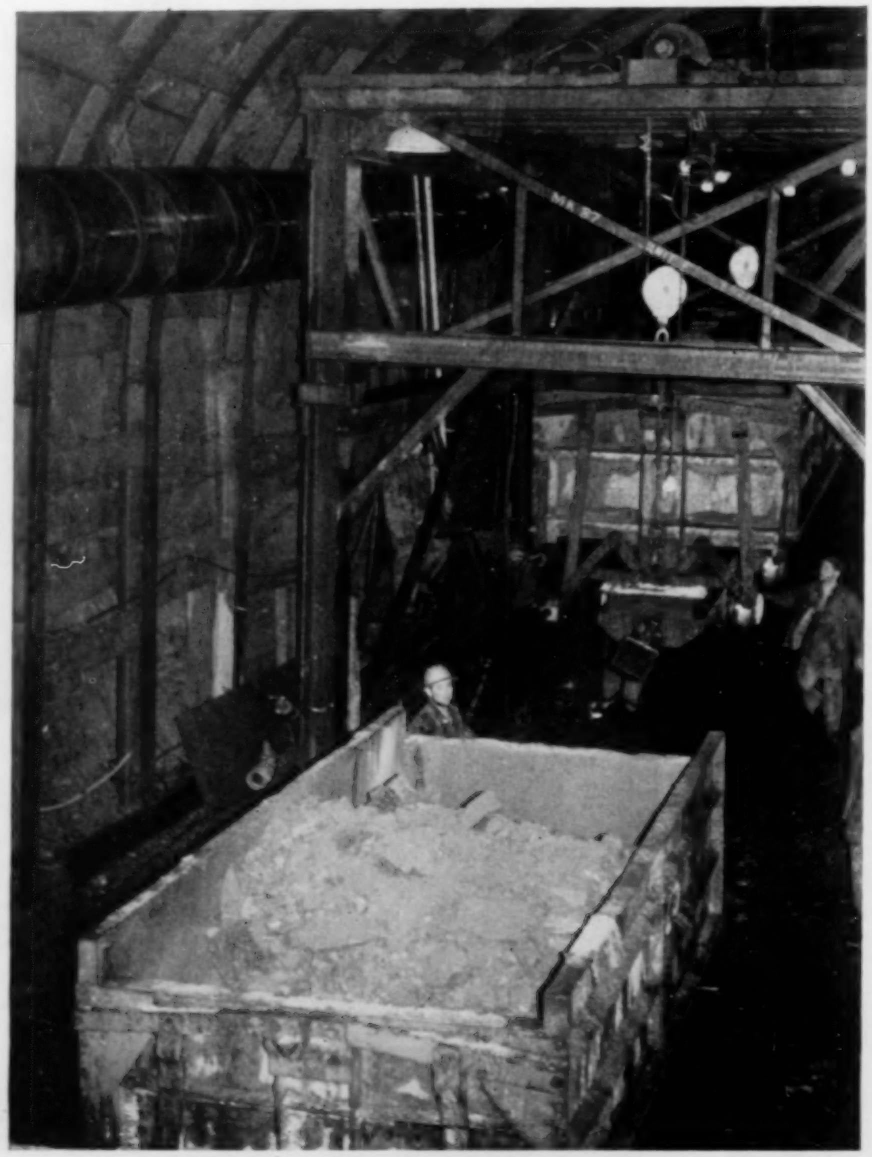
The design of the tunnels was selected after close consideration of engineering and economic factors, including friction losses and construction and operating costs. Friction losses and cost estimates were based on the use of steel supports and on a concrete lining for 10 percent of the total length, or wherever required for support or to cut off natural watercourses. A single bore of larger cross section would probably need much more support, and, in addition, the twin tunnels offer a greater factor of reliability.

No. 1 Power Tunnel has a cross-sectional area of 527 square feet, and with average overbreak the volume excavated amounts to about 23 cubic yards per lineal foot. It is being advanced from four headings: one from the intake end at Tahtsa Lake; two from an 1800-foot-long adit about midpoint in the Horetzky Creek Valley; and one from a portal at the west end above the Kemano River Valley.

When excavated, the bore will be paved with 6 inches of concrete not only for hydraulic efficiency but because it will be less expensive to do that than to remove all compacted muck from the floor. In order that the first three generating units may be placed in service in or about March, 1954, a coördinated series of dates has been set for the various phases of the rock-removal work. The latest date, that for the completion of the main tunnel exclusive of cleaning and paving, is October, 1953. For each of the four headings involved, this calls for an average advance of 27.1 feet per day on a 3-shift 7-day basis.

Geological Considerations

In general, the 10-mile tunnel extending from east to west will crosscut the formations of the westerly part of the Hazleton series of metamorphosed volcanics and sediments and a section of the coast range batholith. The exact location of the contact between these two main groups, or what will probably prove to be a wide contact zone, has still to be determined, but preliminary field work indicated it to be somewhere

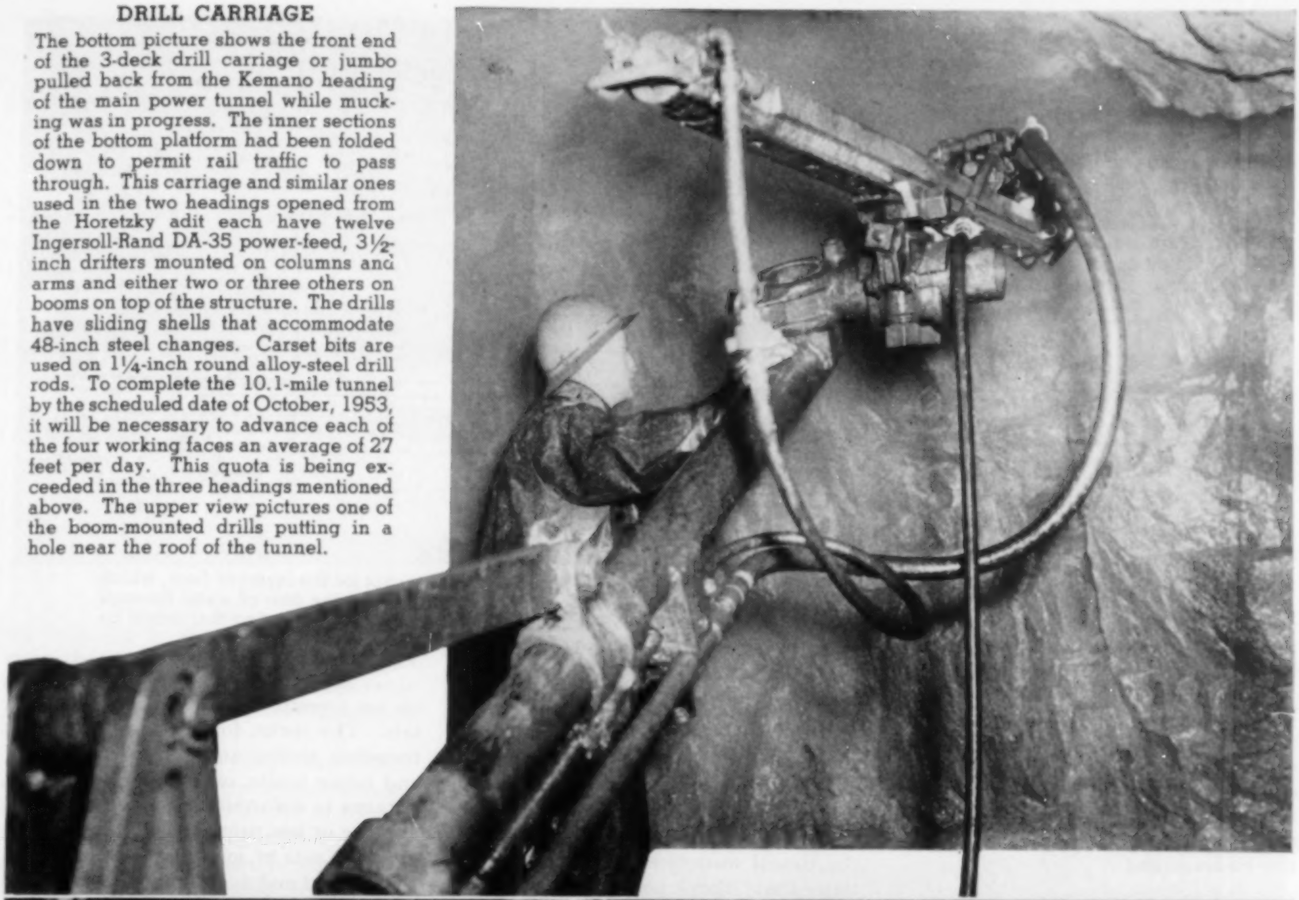


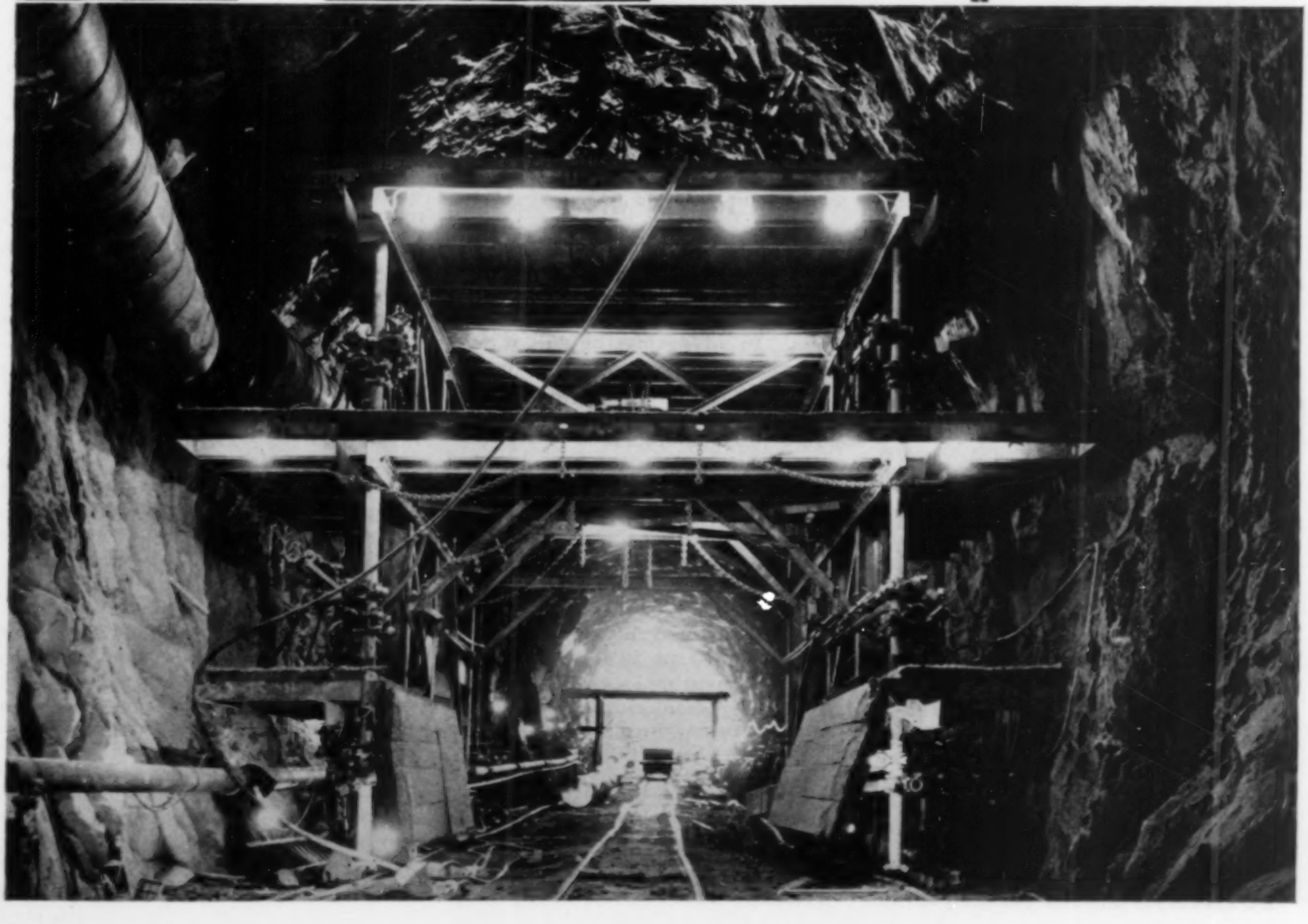
CHERRY PICKER

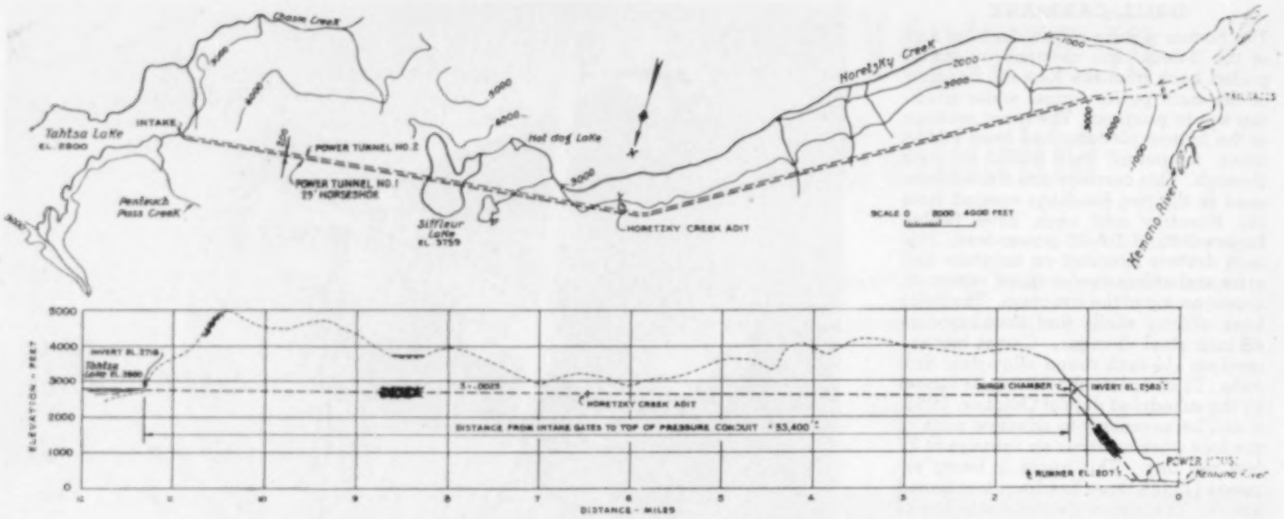
Built into the rear end of each drill carriage used in the Kemano and Heretzky headings is a hoisting device which, as shown here, lifts an empty car so that one that has just been loaded at the tunnel face can be shunted back underneath it. In this manner switching is accomplished with only one track. Lifting is done by an Ingersoll-Rand 10-hp air motor mounted overhead. The cars are of the Granby type and hold 6 cubic yards each.

DRILL CARRIAGE

The bottom picture shows the front end of the 3-deck drill carriage or jumbo pulled back from the Kemano heading of the main power tunnel while mucking was in progress. The inner sections of the bottom platform had been folded down to permit rail traffic to pass through. This carriage and similar ones used in the two headings opened from the Horetzky adit each have twelve Ingersoll-Rand DA-35 power-feed, 3½-inch drifters mounted on columns and arms and either two or three others on booms on top of the structure. The drills have sliding shells that accommodate 48-inch steel changes. Carset bits are used on 1¼-inch round alloy-steel drill rods. To complete the 10.1-mile tunnel by the scheduled date of October, 1953, it will be necessary to advance each of the four working faces an average of 27 feet per day. This quota is being exceeded in the three headings mentioned above. The upper view pictures one of the boom-mounted drills putting in a hole near the roof of the tunnel.






Chasm Creek
Tahtsa Lake
EL. 2800
INTAKE
Penteuch Pass Creek
POWER TUNNEL NO. 2
POWER TUNNEL NO. 1
25' HORSESHOE
Hot dog Lake
Siffleur Lake
EL. 3759
HORETZKY CREEK ADIT
Horetzky Creek
1000
2000
3000
4000
5000
SCALE 0 2000 4000 FEET
TAILRACE
Kemano River
5000
4000
3000
2000
1000
0
ELEVATION - FEET
INVERT EL. 2718
Tahtsa Lake EL. 2800
S = .0025
HORETZKY CREEK ADIT
DISTANCE FROM INTAKE GATES TO TOP OF PRESSURE CONDUIT = 53,400
SURGE CHAMBER
INVERT EL. 2580
POWER HOUSE
Kemano River
RUNNER EL. 80
11
10
9
8
7
6
5
4
3
2
1
0
DISTANCE - MILES

PLAN AND PROFILE OF POWER TUNNELS

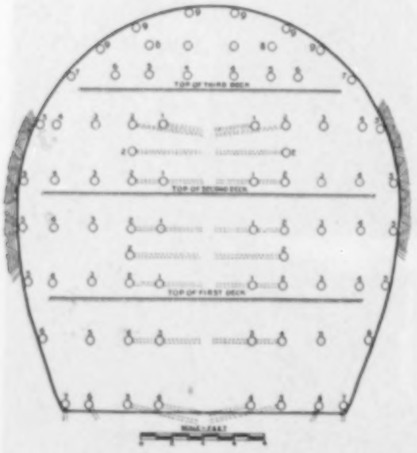
The first of the two projected parallel power tunnels is being driven from four points of attack with a heading at each end and two at the Horetzky Creek adit near midpoint. The bore will have a grade of a quarter of one percent. It will be unlined except for the invert or floor, which will be concreted both to speed the flow of water through reduced friction and to avoid the excavating that would be required to clean up the bottom rock thoroughly.

in the vicinity of the Horetzky area. Exploratory operations consisted in making surface examinations, in putting down a series of diamond-drill holes at and near the Tahtsa Lake end, and in driving a crosscut through the powerhouse site at the Kemano end.

Tahtsa Area

Diamond drilling and examination of the outcrop at the Tahtsa end revealed various successions of volcanics and sediments of the Hazelton group, which is made up for the most part of andesites in beds of different thicknesses. In some places, strata of andesites and other rocks are separated by tongues of granite and, again, by veins of chlorite and epidote.

The rocks show considerable jointing and variation in composition and texture, though experience gained so far in the tunnel work bears out the expectation that they possess considerable strength, durability and tightness. It is therefore unlikely that they will offer serious difficulty as to excavation or support. Their drilling qualities are superior to those of the batholithic rocks of the Kemano area and, judging by present indications, they also break easier.


TOP OF THIRD DECK
TOP OF SECOND DECK
TOP OF FIRST DECK

POWER-TUNNEL DRILL ROUND

Although subject to minor variations, this is the typical hole-arrangement pattern at the three headings being driven with DA-35 drifters. The levels of the three decks of the drill carriage are indicated. The 74 holes average 13 feet in depth and call for a total of about 966 lineal feet of drilling. Approximately 23 cubic yards of rock is broken and removed per lineal foot of advance. The figures show the order of blasting, using seven delays of detonators.

Horetzky Area

The rocks exposed in driving the access tunnel at the Horetzky halfway point are of the Hazelton group composed almost entirely of andesites and basalts. In advancing the adit it was necessary, doubtless because of the alteration effect of surface waters, to provide support in the form of prefabricated steel sets throughout its 1800-foot length. At the junction of the access tunnel and the main bore the rocks appeared much fresher and indicated a more general and stable condition from that point on.

Kemano Area

The excavations for the powerhouse, penstock works, and the west heading of the main tunnel are in the coast-range batholith, consisting generally of quartz diorite and granodiorite with some exposures of pegmatite dykes as well as rocks of a dioritic nature. In the quartz diorite and granodiorite there is quartz in varying abundance, with feldspars and intermediate plagioclases making up the bulk. The principal accessory minerals are hornblende, orthoclase, microcline and biotite, and all but the latter minerals are present as medium to large crystals. The rocks, for the most part, are therefore strong and, except for joints and minor faults, offer homogeneous resistance to deforming stresses.

More or less pronounced and complementary sets of joints have resulted in the vertical and overhanging cliffs which characterize the Kemano area. Except in places where occasional watercourses follow the more marked of these joints and where the leaching action of the surface waters has led to alteration, no difficulty has been experienced so far either in driving or supporting those parts of the workings that lie in the batholithic rocks. It is reasonable to expect that this condition will continue at least to the zone of contact with the Hazelton series. In drilling and blasting the rocks are found to be fairly abrasive (hardness varying with the amount of quartz present), free drilling, and fairly resistant to breakage.

The British Columbia Department of Mines and the Geological Department of the University of British Columbia are aware of the fact that the project offers them a unique opportunity to examine a freshly excavated crosscut extending through the coast-range batholith and contact zone into the Hazelton group of rocks. During the present and the next summer season geologists will study the exposed surfaces, and the findings are bound to give a great deal of valuable fundamental information on the various aspects of general geology, petrography, rock alteration and structure.

Tahtsa Lake Heading

Access to the Tahtsa Lake end of Power Tunnel No. 1 is gained through a 17-foot-diameter adit driven for a distance of 1134 feet on a downgrade vary-

HELICOPTER SERVICE

Horetzky camp (left) is located midway of the power-tunnel line and reached from Kemano by a 7-mile road that traverses rough country. In winter the route is often blocked by snowslides, and then travelers resort to helicopters. Two of the craft are shown below at Kemano when that camp was in an early stage of construction.

ing from 2½ to 4½ percent in order to meet the invert elevation at the intersection. The main heading between this intersection and the intake works proper will be driven later.

Drilling practice in the 25-foot-diameter heading differs from underground rock work at other locations in that it involves the use of air-leg-mounted drills. An accompanying diagram shows how drilling is allocated among sixteen machines mounted on a 3-deck cherry picker-jumbo. The drills are equipped with chisel-bit drill rods with tungsten-carbide inserts set integrally in the upcast end and with a starting gauge of 1.34 inches. Another departure from procedure at Kemano and Horetzky is found in blasting. At Tahtsa, instead of wiring caps individually to a buss-wire system, groups of nine or ten holes are wired in series to the two main wires.

From the main base camp at Kemano the operations at Tahtsa are accessible only by aeroplane or helicopter. To the east, a barge line runs 20 miles to East Tahtsa, which has been connected by a 110-mile road with Burns Lake, a station on the Canadian National Railway. Camp facilities, air compressors, equipment for generating power, as well as complete maintenance shops, are located in Tahtsa.

Horetzky and Kemano Headings

Apart from the Tahtsa section just referred to, all underground rock work on levels is drilled with 3½-inch power-feed drifters instead of air-leg-mounted drills in order to take advantage of the increased rate of advance and longer rounds possible with machines of this size. The drifters are provided with shells permitting a 4-foot steel change, and there is a centralizer for collaring.

Drill steel is 1¼ inches in diameter, round in section and cut in lengths of 5 feet 8 inches, 9 feet 8 inches, and 13 feet 8 inches. The 4-winged detachable bits tipped with tungsten carbide have a 2-inch gauge when new and are used as starters. After successive regrinding they are sorted at gauge intervals of 1/16 inch for work on the second and third drill runs. The ground is granodiorite, and typical speed of penetration is in the range of 17 to 23 inches per minute. Air is discharged at 100 psi by the compressors and delivered to all machines at a minimum pressure of 95 to 100 psi.

An accompaying drawing shows the basic drilling pattern followed in the Kemano and Horetzky headings. This pattern is for general guidance, for, like in all tunnel operations, the immediate supervisory staff can, with discretion, vary the number and arrangement of the holes to some extent. It will be noted that a double "V" cut is commonly used throughout all narrow workings and that both cuts and square-ups are blasted at one time. In the Horetzky and Kemano headings on the main bore, as well as in all close-quarter workings in connection with the powerhouse, holes are wired individually to a main buss-wire system.

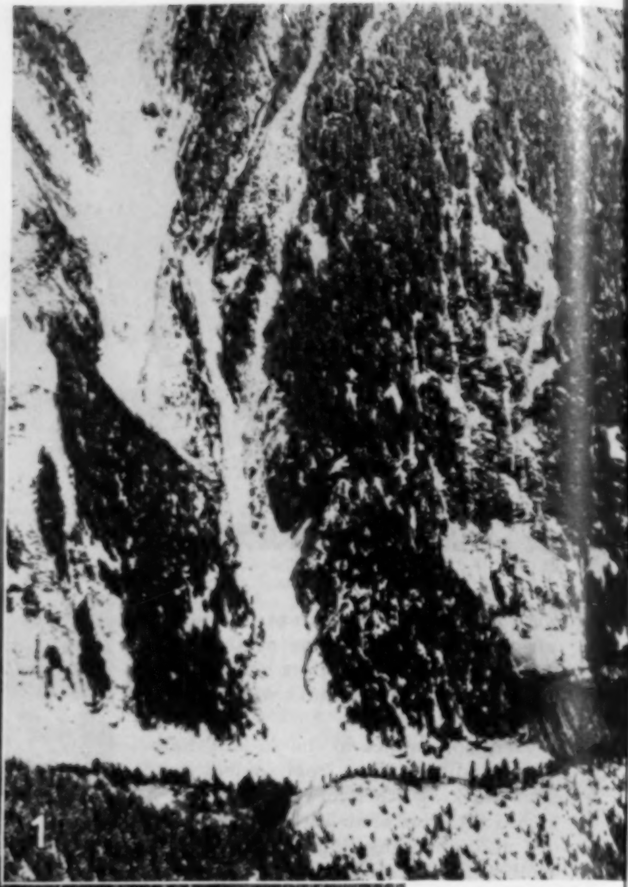
Also indicated in the basic drilling pattern is the decking arrangement of the cherry picker-jumbo designed and fabricated for this job. The carriage is divided into two main compartments, the front or face section and the back or cherry-picker half. The front compartment is rigged for the column-and-arm mounting of twelve 3½-inch power-feed drifters and the hydraulic mounting of two or three similar drills on the top deck.

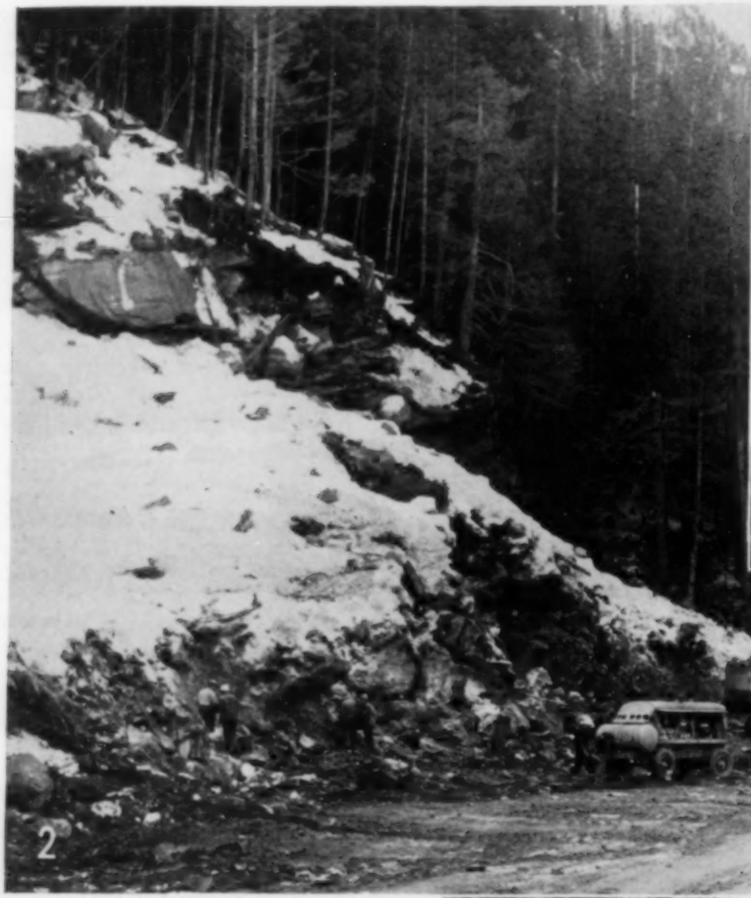
The cherry-picker is fitted with a 10-hp hoist and is used in clearing operations to effect rapid changing of cars at the face. The jumbo travels on its own gantry rails of 14-foot gauge and is moved by 8-ton storage-battery locomotives. The latter are equipped with a trolley post, and as the length of the tunnel increases beyond the economic scope of the batteries a 440-volt trolley line will be carried into the heading.

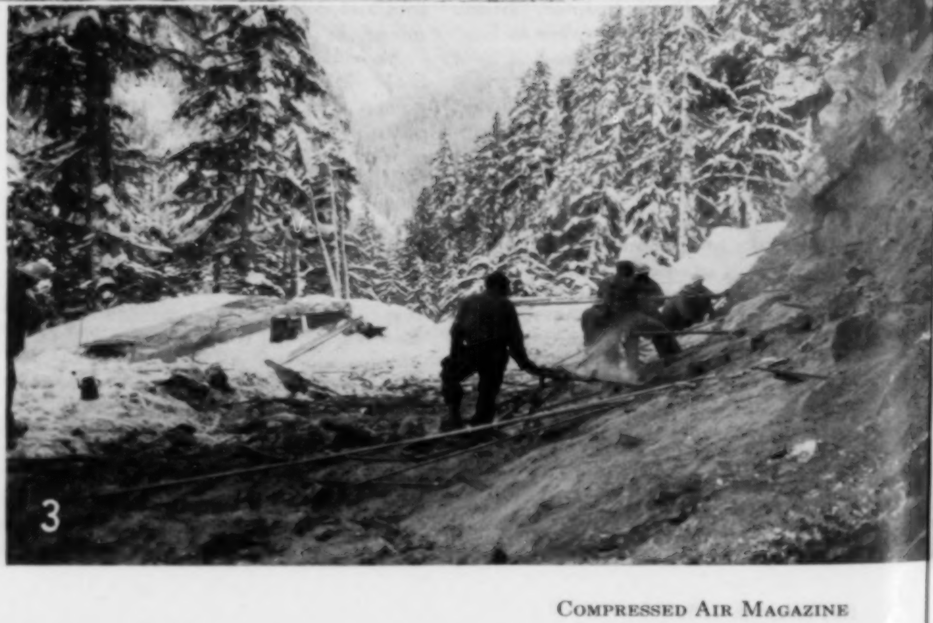
Mucking is done with a 100-hp electric bucket-conveyor loader which delivers to 6-cubic-yard Granby-type cars that are changed at the face by the cherry-picker. When full, they are spotted on a siding maintained within 1000 feet of the face for gathering and hauling to dumps situated outside the portal.

Access to the main bore at the Horetzky halfway point is gained through an adit driven full heading from its portal for a distance of 1800 feet. It is supported virtually throughout its entire length with steel sets fabricated from 8-inch H-beams. The camp at Horetzky is reached from the main Kemano camp over a 6-mile road that was constructed for the purpose. Because occasional sea-

THE ROAD TO KEMANO







These pictures portray some of the difficulties encountered in building access roads in the rugged British Columbia terrain.

1 A partly excavated gash on the precipitous mountain slope is seen near the bottom. All the other views are close-ups in this same general vicinity.

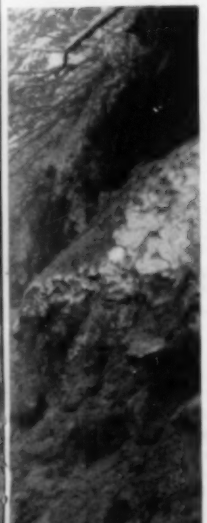
2 A drilling crew and a shovel getting riprap out of an improvised roadside quarry.

3 A drilling crew putting toe holes in a cliff in a wintry setting.

4 An I-R portable air compressor on a wooden skid is stationed at a hairpin turn in a switchback used to climb the steep hillside.

5 An advance guard carving a ledge along a sheer cliff. Note the air hoses coming down from above.

5



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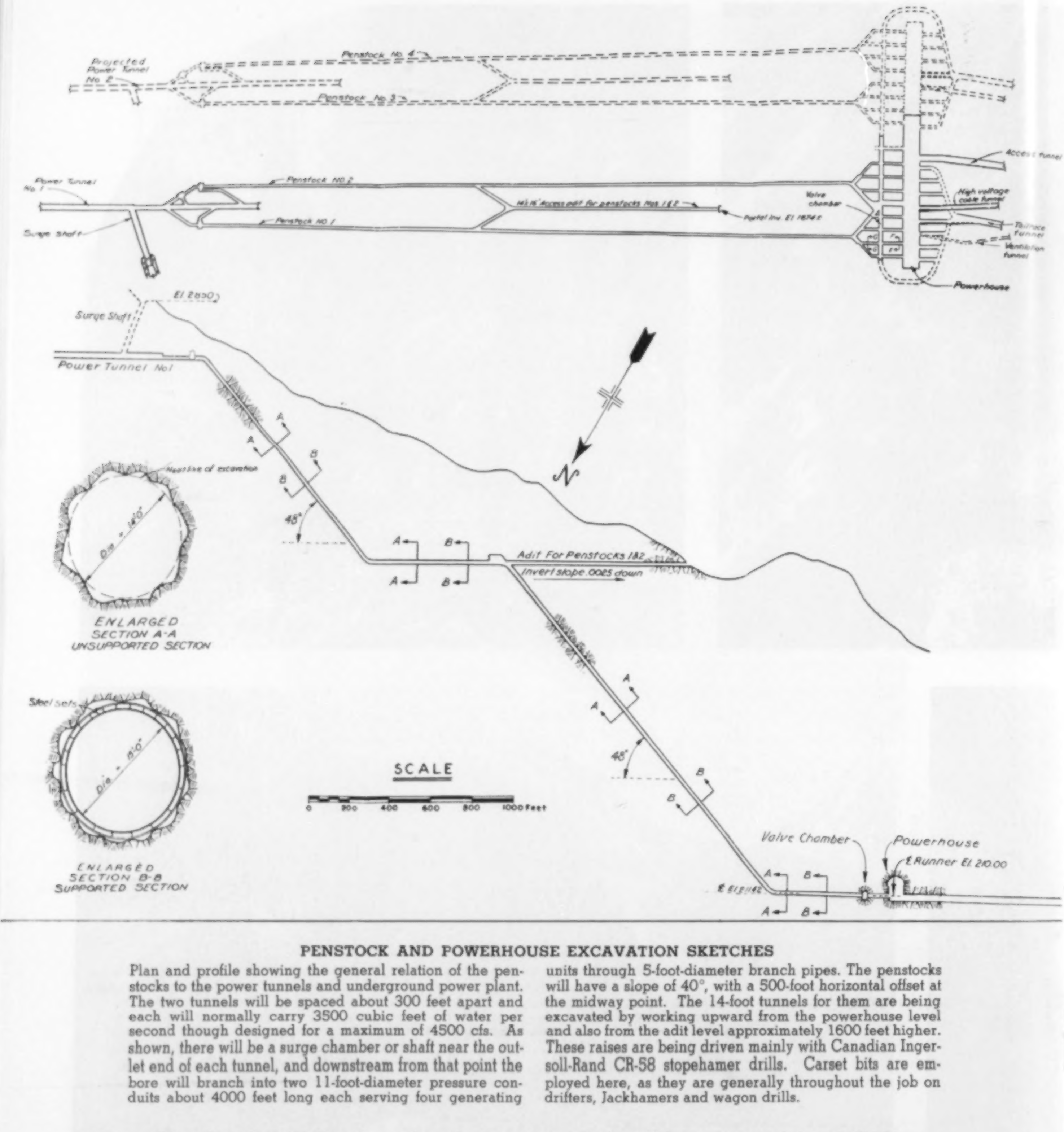

Projected Power Tunnel No. 2
Penstock No. 4
Penstock No. 3
Power Tunnel No. 1
Penstock NO. 2
14' x 16' Access adit for penstocks Nos. 1 & 2
Portal Inv. El. 1674 ±
Penstock NO. 1
Surge Shaft
Valve chamber
Access tunnel
High voltage cable tunnel
Tailrace tunnel
Ventilation tunnel
Powerhouse
El. 2650
Surge Shaft
Power Tunnel No1
Neat line of excavation
Dia = 14'0"
ENLARGED SECTION A-A UNSUPPORTED SECTION
Steel sets
Dia = 15'0"
ENLARGED SECTION B-B SUPPORTED SECTION
A
B
45°
Adit For Penstocks 1&2
Invert slope .0025 down
N
SCALE
0 200 400 600 800 1000 Feet
Valve Chamber
Powerhouse
℄ Runner El. 210.00
℄ El. 211.42

PENSTOCK AND POWERHOUSE EXCAVATION SKETCHES

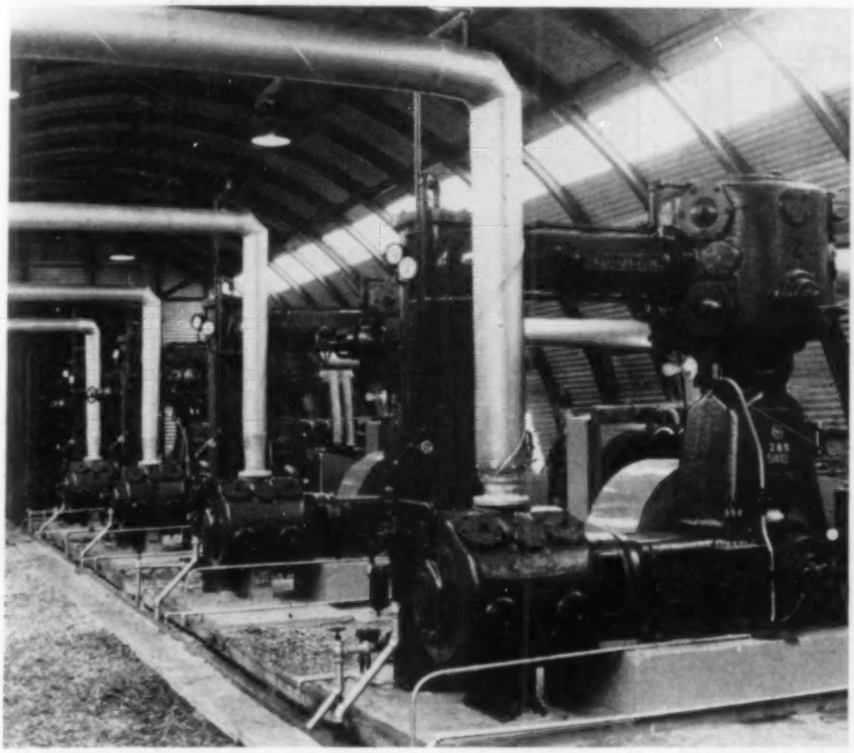
Plan and profile showing the general relation of the penstocks to the power tunnels and underground power plant. The two tunnels will be spaced about 300 feet apart and each will normally carry 3500 cubic feet of water per second though designed for a maximum of 4500 cfs. As shown, there will be a surge chamber or shaft near the outlet end of each tunnel, and downstream from that point the bore will branch into two 11-foot-diameter pressure conduits about 4000 feet long each serving four generating units through 5-foot-diameter branch pipes. The penstocks will have a slope of 40°, with a 500-foot horizontal offset at the midway point. The 14-foot tunnels for them are being excavated by working upward from the powerhouse level and also from the adit level approximately 1600 feet higher. These raises are being driven mainly with Canadian Ingersoll-Rand CR-58 stopehamer drills. Carset bits are employed here, as they are generally throughout the job on drifters, Jackhamers and wagon drills.

sonal snowslides affect the reliability of this line of communication, the camp maintains an ample supply of stores and is completely equipped with shops, compressors and power-generating units.

The heading at the Kemano end is being pushed forward from a portal at about Elevation 2600 above the powerhouse workings. The camp near this portal offers living accommodations only because it is served with everything, including compressed air and electric power, from the base camp at the foot of the mountain by an aerial tramway that runs in a clearing, now a conspicuous feature of the valley. The tramway, which also serves a portal on the 1600 level, can carry a 30-ton load and is operated by means of a 96-inch double-drum hoist powered by a 350-bhp induction motor. The pull line consists of 11,800 feet of 1⅜-inch rope arranged as a main-and-tail system, and the two track cables are 2½ inches in diameter.

Penstock Workings

From the 2600 level the No. 1 Power Tunnel will branch off into two steel penstocks shown in plan and section in an accompanying drawing in relation to the power-plant ancillary workings. The arrangement will be duplicated as and when the No. 2 Power Tunnel is taken in hand. The water will be divided between the 11-foot-diameter penstocks, each of which is to be carried in a 14-foot-diameter, backfilled and grouted



COMPRESSORS AT HORETZKY

Four Canadian Ingersoll-Rand Type XVH air compressors at the Horetzky adit. In the absence of power lines, they are driven by General Motors diesel engines. Each compressor has a capacity of 1100 cfm. Eighteen stationary machines of this type are scattered over the job in addition to more than twenty I-R portable compressors of various sizes. The major use of compressed air is for operating rock drills, but appreciable quantities are also consumed by hoists, sump pumps, drill-steel furnaces and sharpeners, Jackbit grinders and pneumatic tools.

raise. It will be controlled by an oil-actuated butterfly valve installed a short distance below the wye branch, and an air-inlet valve will be included so that air may be admitted whenever it becomes necessary to drain the penstock for inspection and maintenance.

Each raise is being driven on a 48° slope from two headings, one from the powerhouse invert elevation and the other from an adit at Elevation 1676 where there is a horizontal offset of about 600 feet for constructional convenience. One section extends for a distance of 1980 lineal feet to the 1600-foot level and the other 1275 feet from that point to the 2600 level. At the time the project was visited, actual work had not been begun, but the plan was to drive 6x8-foot pilot raises and subsequently slash them to the neat lines by drilling from a jumbo designed for the purpose.

At the turbine elevation each penstock will deliver to a wye manifold with symmetrically arranged 45° offsets and four 5-foot-diameter branch pipes. Each of the turbine inlets will be controlled by a spherical valve and will serve one 140,000-hp unit. The inlets are to be enclosed in 9-foot-diameter circular tunnels backfilled with concrete.

In order that the penstocks, manifolds, and turbine branches might be equal to the pressure of 1236 psi created by the operating head and surge, these facilities have been carefully designed and subjected to intensive study, including an investigation of the modulus of elasticity of the enclosing rocks—work that merits a brief description. It was necessary to determine this factor so as to compute the relative proportion of the imposed load to be carried by the steel and by the surrounding rocks. Also one of the considerations that led to the selection of an underground site for the powerhouse and penstocks was the need of holding in check the high hydraulic pressures developed in an installation of the size contemplated.

To obtain the desired information, a spherical chamber was cut in the quartz-diorite rock at a point 25 feet away from the wall of and 15 feet below the floor of an exploratory tunnel that had been driven during the early stages of the project. In it was put a hollow steel ball 10 feet in diameter and having walls ½ inch thick. The chamber was then backfilled with concrete and grouted.

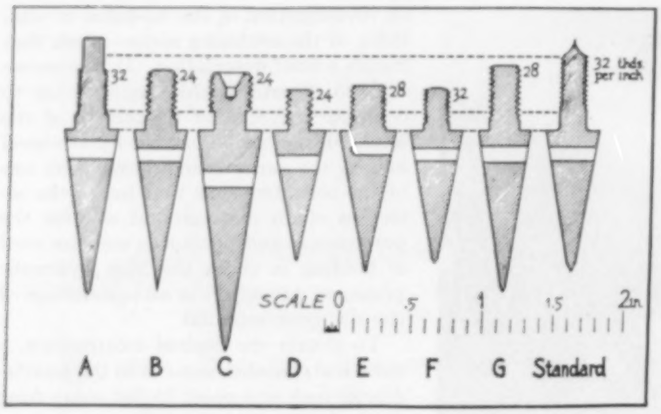
With diamond drills, twenty-six 3-inch holes 55 feet long were drilled from the sphere through points on the periphery on meridians and latitudes 45° apart. To establish the diametric strains in the steel shell, six radial steel rods were placed in the ball and Carlson gauges were set in the drill holes at points 10, 25, 40 and 55 feet from the periphery of the sphere. The latter was next filled with water and the various strains were recorded at intervals as the pressure was increased from zero to 3600 psi.

As a result of this investigation it was indicated in advance that the bulk modulus of elasticity of the rock was in the order of 1,500,000, a figure that confirmed those given by most authorities for granitic rocks.

(To be concluded)

MUCKING MACHINE

A Conway 100-hp, electric-driven loader used to handle muck at tunnel headings. Broken rock is scooped up by the bucket and dumped backward onto a belt that conveys it to a car.


32
24
24
24
28
32
28
32 thds per inch
SCALE 0
.5
1
1.5
2in
A
B
C
D
E
F
G
Standard

REPLACEMENT POINTS

Imagine the trouble you would have if each manufacturer of light bulbs designed the screw base according to his own ideas. You would then have to search for the particular kind that would fit your sockets. Something akin to this plagues the shopper for plumb-bob points. A few of the variations are pictured. The proposed standard point is on the extreme right.

Standardized Plumb-Bob Points

James Hirt

STANDARDIZATION of plumb-bob points is the goal of the Service and Supply Department of the California Division of Highways and a Standardization Committee composed of civil and mechanical engineers, manufacturers and distributors. One or more bobs are used by every survey crew to transfer a point on the ground to a point some distance above it, or vice versa, and a transit is centered over the survey point on the ground by means of a plumb bob. Chainmen use them in order to measure ground points with a tape supported only at the ends.

Normal service not only results in worn, damaged, or broken points but occasionally also in lost bobs, necessitating replacement. Also, a point is often used as a scribe to mark a point on a rock or concrete, a common cause of wear. That there is need of a standard plumb-bob point has been emphasized by the great variety now being manufactured and the difficulty experienced in replacing them. It is estimated that the several hundred thousand precision bobs produced in the United States each year range in weight from 4 to 96 ounces, with the 10- to 16-ounce type the most popular. Different thread sizes and threaded connections, varying major nominal diameters, numerous kinds of points (anywhere from an easily broken needle point to a very blunt and therefore inaccurate point) and many sizes of drill holes, all contribute to the problem of correct replacement.

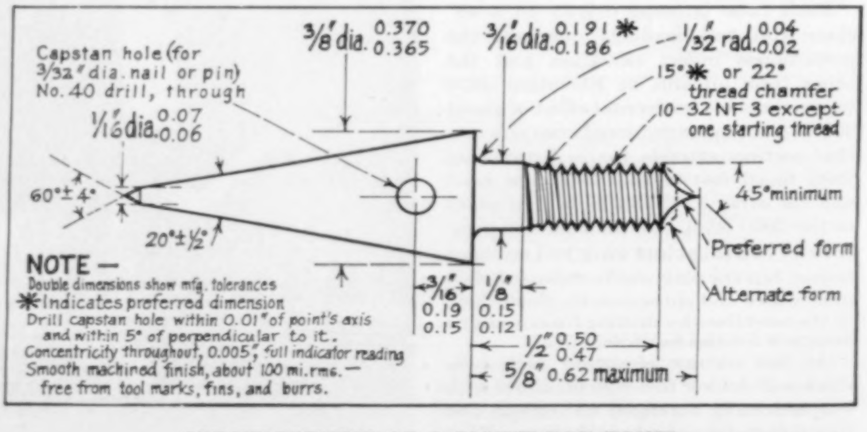
Usually, the manufacturer's or distributor's name is marked on a bob, but as the latter is made of brass the name is often obliterated. With no means of identification, a surveyor will very likely have to trust to luck if he wants to continue using the bob and can't give the catalogue number or spare the point as a sample to be sent to the supplier. The distributor therefore has to submit samples from which the surveyor can select a point to fit his bob. Even when the manufacturer is known there is no guarantee that the points ordered will fit, because one distributor has furnished bobs with three different points within a 10-year period. All this trouble and delay increases the supplier's overhead and wastes the surveyor's time.

To obviate the difficulty, and to develop a point satisfactory to all concerned, the Standardization Committee has submitted a tentative standard to the National Bureau of Standards. Several American manufacturers are already producing replacement points conforming to its specifications. In brief, the committee's standard calls for a plumb-bob point with a major nominal diameter of ⅜ inch because 90 percent of those made today are of this size. A No. 40 hole, drilled clear through, is specified. Although this is larger than that generally adopted, it will permit the use of more readily available pins or nails for removal or installation. The threaded connection, the part which has varied the most and has caused much confusion and delay in obtaining replacements, has a 10-32 thread.

Only the form of the bob point is dealt with in this tentative standard, nothing is said about the kind of material of which it is to be manufactured. However, the Service and Supply Department plans to prepare specifications covering the entire plumb bob so that not only the point but also the bob, the cap and all materials used will be standardized.

Don't you dare shoot any birds with that thing, young man!

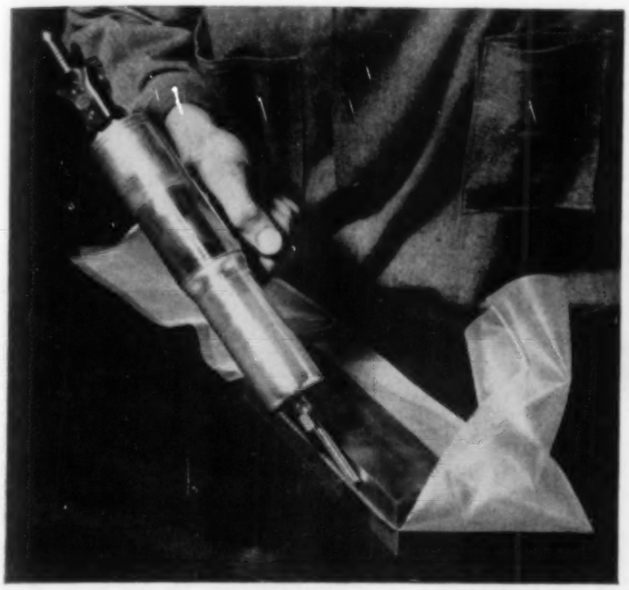
Acknowledgment is made to "California Highways & Public Works" as source of material.

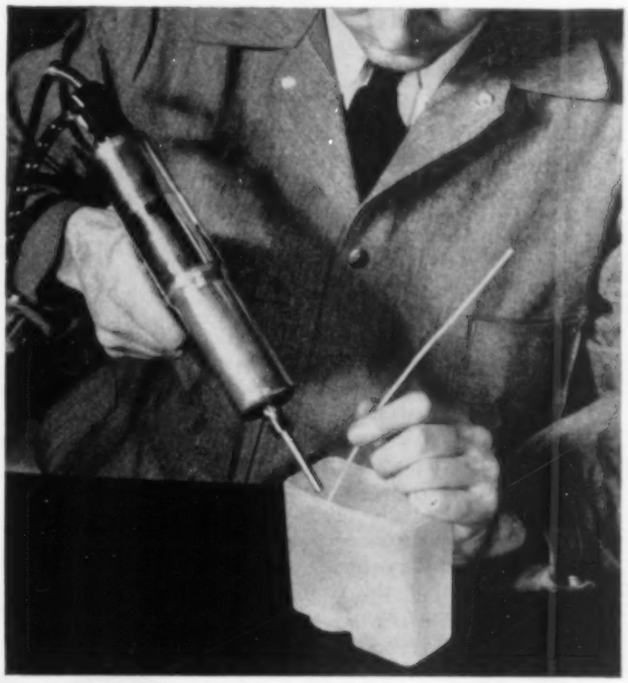

3/8" dia. 0.370 0.365
3/16" dia. 0.191 ✱ 0.186
1/32" rad. 0.04 0.02
Capstan hole (for 3/32" dia. nail or pin) No. 40 drill, through
15° ✱ or 22° thread chamfer
10-32 NF 3 except one starting thread
1/16" dia. 0.07 0.06
60° ± 4°
45° minimum
20° ± 1/2°
Preferred form
Alternate form
NOTE —
Double dimensions show mfg. tolerances
✱ Indicates preferred dimension
Drill capstan hole within 0.01" of point's axis and within 5° of perpendicular to it.
Concentricity throughout, 0.005", full indicator reading
Smooth machined finish, about 100 mi. rms. — free from tool marks, fins, and burrs.
3/16" 0.19 0.15
1/8" 0.15 0.12
1/2" 0.50 0.47
5/8" 0.62 maximum

SPECIFICATIONS OF A PLUMB-BOB POINT

Unless you are a surveyor, we know you won't pore over this sketch, but it gives you a rough idea of how many things there are to consider in designing such a relatively small and simple thing as a plumb-bob point with extreme dimensions of ⅜-inch by approximately 1½ inches. This is the proposed American standard point that is expected to reduce headaches among the transit-and-tape screw. The capstan hole is for inserting a nail or pin to turn the point for removing or replacing it. This tentative standard has not yet been adopted but some manufacturers are already following it.

Flameless Welding





HOT-AIR GUN

Heated compressed air issuing from the nozzle quickly softens low-melt plastics and makes a variety of "welding" jobs possible. In the view above, the edges of a thermoplastic sheet are being heat-sealed to produce a sleeve. The stock is held between two bars of metal that mask it and limit the width of the sealed seam. The other picture shows a Hot-Jet gun fusing a filler rod in the process of welding and assembling a pair of thermoplastic moldings.

IN WELDING, heat-sealing, spot-heating and "brazing" low-melt plastics, such as polyethylene, polyvinyl chloride, polystyrene and Lucite and Plexiglas acrylics, care must be taken to prevent burning or oxidizing of the materials. For work of this kind, DeBell & Richardson, Inc., has developed a Hot-Jet process that depends for its effectiveness on a flameless jet that is created by heating compressed air and issues from a hand-held gun with a glass-lined, stainless-steel nozzle. In addition, the method involves the use of a compressor delivering air at a maximum pressure of 300 psi; a regulating valve to reduce the line pressure to 5-60 psi; and a Powerstat rated at 7½ amperes, 115 volts, 60 cycles alternating current to convert power from a transmission system into the voltage required for different heating operations.

The air flows through a series of passages in a hermetically sealed housing that provides 227 inches of heat-exchanger surface. On its way to the nozzle it is progressively heated by means of a "cartridge" which receives electrical energy from the Powerstat. The heat-transfer efficiency of the equipment is rated at 60 to 70 percent, which is more than three times that of the average automobile engine. However, an English firm is reportedly designing a small ultrasonic siren with more than 90 percent efficiency that may serve the same general purpose. Output pressures and temperatures of the gun are regulated in accordance with the dimensions and melting points of the materials and the operating conditions.

Plastics are prepared for Hot-Jet processing much the same as metals are made ready for welding with gas or electric arc equipment; that is, by cleaning or degreasing the surfaces which must be heated and by beveling or spacing components where neat assembly joints are required. Then, if necessary, the device may be used like a gas-welding torch to fuse a filler rod so as to mate materials or parts.

Thermoplastic sheets, tubes, and other shapes as well as materials with a thickness of $\frac{1}{16}$ inch and upward have been satisfactorily joined, and for most purposes the fillers have consisted of $\frac{3}{32}$-inch-diameter rods of the same chemical make-up as the plastics handled. Welding speeds have ranged from about 3 to 6 inches per minute, depending upon the rate of heat transfer which varies with materials of different compositions and dimensions.

Where heat-sealing has been specified for such operations as sandwiching photographs and identification cards between layers of transparent plastics, Hot-Jet guns have been used to provide the necessary vertical pressure and temperature to fuse the stacked laminates.

Thermosetting plastics, or substances which cannot be resoftened after they have been solidified with heat, are not as suitable as thermoplastics for the Hot-Jet process. However, thermosetting or synthetic-enamel coatings can be readily solidified after they have been applied in the conventional manner if they are exposed to "hot air" with relatively little pressure. And heat-cured moldings of plastic of this kind have been quickly bonded together by use of the flameless jet to set or cure adhesives on their mating surfaces. Incidentally, Hot-Jet guns are desirable assembly tools for all types of plastic moldings and casts because they make it possible to weld relatively simple parts into intricate products, thus eliminating the need of costly and complex molds or dies.

The maximum heat output of the gun rarely exceeds 650°F at a point ¼ inch from the nozzle. This cannot normally be used in work with metals (some will fuse at much lower temperatures) because the oxygen in the air may cause undesirable reactions in molten alloys. However, tests have shown that Hot-Jet equipment can be operated with an inert gas such as nitrogen or carbon dioxide instead of air, so that certain low-melt materials, lead-bismuth alloys, for example, can be welded or liquefied without danger of oxidization. Therefore, it is not unreasonable to expect that Hot-Jet guns will eventually be used in connection with special accessories for purposes for which they are not now regarded as practical—such, perhaps, as applying coatings of thermoplastics and metals whose temperature resistance obviates the use of standard hot-spray equipment.

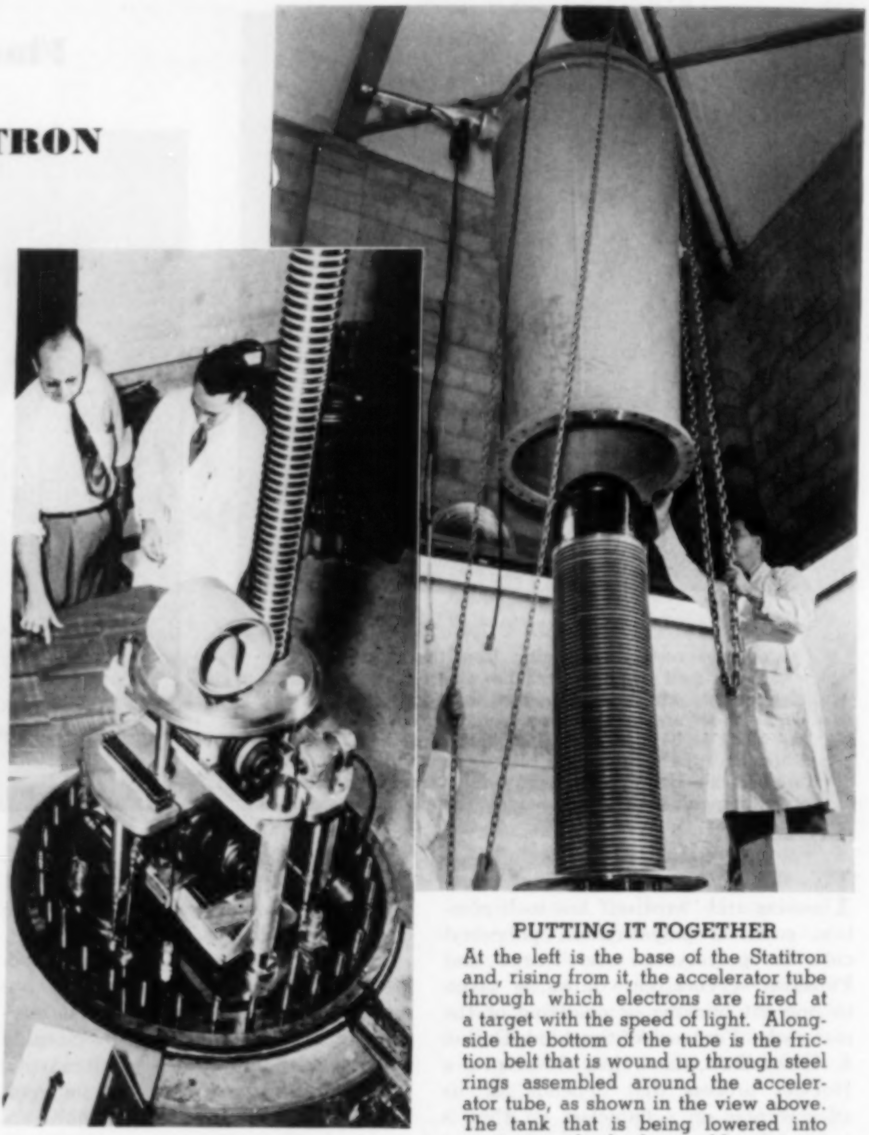
THE STATITRON

STATITRON is a name that has been coined for an unusual combination of pneumatic and electronic equipment being used at North American Aviation, Inc., Los Angeles, Calif., to improve the quality of aircraft materials and parts. In principle, the unit may be described as the first commercially practical version of the Van de Graaf electrostatic generators used by nuclear physicists at the Brookhaven, Argonne, Oak Ridge, and Los Alamos national laboratories. However, its purpose is to rearrange—not to smash—the atoms in material substances by converting ordinary electrical current into a high-voltage electron beam comparable in some respects to the output of an X-ray machine.

The operation of the Statitron involves the following steps in the order in which they are listed:

(1) Conversion of alternating current from a factory power line into direct current by means of a conventional high-voltage transformer and rectifier in order to energize a series of charging needles.

(2) Transfer of high-voltage electrostatic charges from the needles to a friction belt, which is vertically mounted on a pair of rollers and rotated by power transmitted from an electric motor through the lower roller.



PUTTING IT TOGETHER

At the left is the base of the Statitron and, rising from it, the accelerator tube through which electrons are fired at a target with the speed of light. Alongside the bottom of the tube is the friction belt that is wound up through steel rings assembled around the accelerator tube, as shown in the view above. The tank that is being lowered into position as the final assembly step was later charged with air at a pressure of 200 psi.

LOADING UP

C. J. Thompson, mechanical engineer at North American Aviation, Inc., pours liquid air into a trap. Its purpose is to remove any trace of moisture from the evacuated space within the accelerator tube.

(3) Elevation of the charges by the friction belt through a steel ring column so that the charges can be removed from the belt by a series of discharge needles and accumulated in a dome at the top of the column.

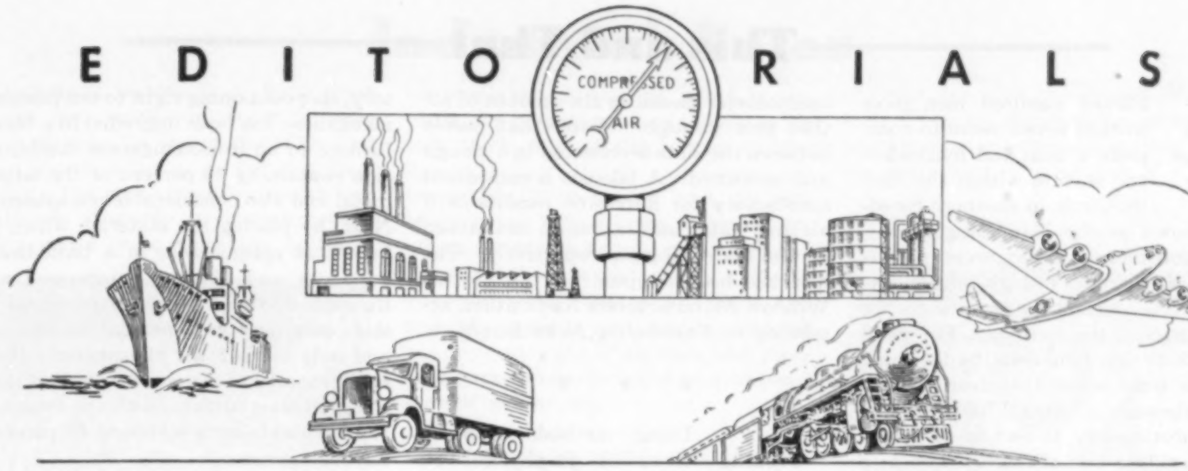
(4) Acceleration of the accumulated electrical particles in the dome by a special generator, transformer, and filament to shoot them through a vertical tube at a target below the base of the Statitron.

As many as 60 thousand billion electrons per second can be fired with the approximate speed of light (186,000 miles per second) in the process of bombarding the target. This involves the use of pneumatic equipment, first, to evacuate the vertical accelerator tube and, second, to maintain dry-air operational pressures of 200 psi in a cylindrical tank which houses the Statitron when in service. Positive and negative pressures are required to assure the effective use of the input electric power.

Specific applications for the Statitron cannot be discussed because of national-security regulations. However, Dr. Donald Eggen, physicist in charge of the project, has provided the following general explanation of at least one important service: "If you take a thin piece of metal and bend it back and forth several times, it eventually gets hard and breaks . . . . With the Statitron, we can get the same effect; and, in addition, we can find out why the metal breaks."

Compared with the electrostatic generators used in producing A-bombs, the Statitron is exceptionally inexpensive and compact. It is only 9½ feet tall and has a maximum diameter of 40 inches when fully assembled. The unit is installed in a specially insulated room and operated by remote control by engineers outside of the room. While the machine produces no radioisotopes or materials with lingering radioactivity, it does create invisible electronic radiations that greatly exceed the radiation tolerance of the human body.

EDITORIALS



THE WATER PROBLEM

WATER is without doubt the most essential substance in the universe. When too much of it falls to the ground, we have disastrous floods such as those that struck the Missouri Valley last spring. Conversely, when Nature is niggardly with precipitation, the land parches and crops are dwarfed, as has been the case in the Middle South and New England in recent weeks.

Water is the key to agricultural success and all human endeavor is dependent on an adequate food supply. In the semiarid West a good water right, i.e., a prior claim on water flowing in an irrigation canal serving the property, is the most valuable adjunct a tract of rural land can possess. Because of the imbalance in the natural distribution of moisture, great construction undertakings costing millions of dollars have been launched to transport water long distances, even through mountains. The Central Valley Project in California and the Colorado-Big Thompson Project in Colorado are outstanding examples.

Some of our big cities have reached far into the hinterland for water. Los Angeles and its environs, with their aqueduct that carries the precious fluid nearly 300 miles from the Colorado River naturally come to mind here. Across the continent we find New York going farther and farther into the mountains to keep pace with the growing demand for water. Its water department has been engaged more than half the time during the past fifty years in construction designed to augment the supply. For more than ten years now it has been building dams, tunnels and other works on the upper reaches of the Delaware, a stream to which some New Jersey and Pennsylvania cities, notably Philadelphia, also are looking as a future source of water.

Water is so vital to national defense preparations that the Federal Government has established a Water Resources Division to serve as a clearing house for information on water resources for industrial, public and domestic purposes as well as on the disposal of sewage and industrial wastes. This agency has authority to pass on applications made to the National Production Authority for materials needed for water supply and sewerage construction and it has allotted large quantities of steel, copper and aluminum for these purposes.

For the want of water, defense production has been seriously curtailed in several sections. In Wichita, Kan., breaks in the main water supply line idled 50,000 workers in airplane factories for several days. Lack of rainfall on the Canadian River watershed threatened the development of a serious situation in Oklahoma City and it was averted by quickly making available 10,900 feet of pipe with which to tap a supplemental source of water supply.

The President's Materials Policy Commission's report, better known as the Paley report, put the spotlight on the essentiality of water for industrial operations and revealed some startling facts. It disclosed, for instance, that eight times as much water was used by industries in 1950 as in 1900, although the population only doubled during the same period. This is explained by the fact that many of the newer industries that have sprung up during the intervening years are heavy water users. By way of illustration, it is estimated that 1,050,000 gallons of water is required to produce 1000 barrels of aviation gasoline, and 15,800,000 gallons to turn out 1000 gallons of synthetic gasoline. A ton of rolled steel requires 80,000 to 110,000 gallons, a ton of sulphate paper pulp 64,000 to 70,000 gallons, and a ton of viscose rayon from 180,000 to 200,000 gallons.

The report points out that it is less expensive to locate industrial plants near a good source of water and transmit electrical power a considerable distance than vice versa. Studies indicate that a 26-inch water line calls for eight times the material and ten times the money that are needed to build a power line with capacity to serve a fair-sized factory.

Pollution is an important aspect of the water problem because water can often be reused if it is not contaminated. But, if human and industrial wastes are improperly handled, they can foul a mighty stream and prevent communities farther along its course from using its water without first giving it extensive chemical treatment. As the United States Public Health Service aptly puts it, "The river is a mainstay of modern civilization, and a pleasant companion to man, if undefiled, but an obstruction to economic and social progress, and a menace to life and health, if polluted."

Three-quarters of the earth's surface is covered with oceans. From this aqueous expanse, as well as from the rivers and lakes, the sun eternally draws vapor, which later condenses and falls from the clouds to either seep into the ground or run off to the sea. This never-ending cycle juggles the same water over and over. There is no more and no less moisture now than there was when Noah launched his ark, but the distribution changes markedly and sometimes abruptly. Witness that in the western part of the nation rainfall ranges from practically nil in portions of the Southwest to 100 inches a year in some sections of Washington. Industry and agriculture both follow water. That is why most of our factories and farms are in the Midwest and East. It could not be otherwise. The western third of the country could not support the concentrations of people that are found in some of the more populous areas farther east.

As the country continues to grow, the water problem will steadily become more acute and there will come a time when we shall have to turn to seawater to solve it. Several workable processes for desalting ocean water have been devised, but they are too expensive to handle large volumes. In June of this year a bill to appropriate $20 million for the development of more practical apparatus passed the House of Representatives. Further research will perhaps produce economical systems and one may well imagine that they will be in extensive use before many more decades have passed.

This and That

High Voltage Line

Eleven hundred men have worked seven years to complete a dam and hydroelectric station within the Arctic Circle in northern Sweden. Known as the Harspranget Project, it embodies an underground powerhouse and 600 miles of high-tension line to carry the current southward to the central part of the country. The main dam is 2520 feet long and 164 feet high and was built while the river was diverted through a tunnel 700 feet long and approximately 45 feet in diameter. A smaller dam was also erected to help create the reservoir.

The power-plant equipment consists of three 115,000-kw generators each driven by a Francis turbine. It occupies a 330-foot long room as high as a 5-story building and is carved out of solid rock. A tunnel 9500 feet long carries the water back to the river after it has passed the turbines. The transmission line operates at a potential of 380,000 volts, said to be the highest on record. It cost $20 million and the generating facilities $45 million.

* * *

To Ship Molten Sulphur

A barge designed to carry molten sulphur was recently launched at the Bethlehem Steel Company shipyard in Beaumont, Texas. It has a capacity of 1000 tons and is insulated with fiber glass that will keep the cargo at a temperature of near 300°F during its shipment from Texas Gulf Sulphur Company's mine near Liberty, Texas, to the plant of Consolidated Chemical Industries, Inc. in Houston. The sulphur is brought up from underground deposits in molten condition by sending down superheated steam. Transporting it in molten rather than in dry form makes remelting unnecessary when it is used by Consolidated in making sulphuric acid. Freeport Sulphur Company has for some time been shipping molten sulphur in barges from swampland producing areas to cooling and drying locations, but they have never previously been employed elsewhere. The new barge cost $160,000.

* * *

Giving Windows the Works

A blower driven by an airplane engine creates a blast of 140 miles per hour for testing shuttered windows in Florida. From behind the engine water is introduced at a rate of 20 gpm, the air and water being directed against a window for twelve minutes. Behind each one is a long metal funnel ending in a 6x6-inch opening, where a sensitive anemometer measures the amount of air that gets through. Water that passes between the slats is collected in a trough and measured. A jalousie is considered satisfactory for hurricane conditions if air and water infiltration do not exceed 75 cfm and 0.20 gpm respectively. The test has been adopted by the Florida Window Manufacturers Association, according to *Engineering News-Record.*

* * *

Probing Roman Church

Using methods akin to those of geophysical oil seekers, the Rev. Joseph Lynch, seismologist at Fordham University in New York City, has located hollow spaces underneath the marble floor of the basilica of St. Peter's in Rome's Vatican City. He thinks he may have found the site of Nero's Circus, where St. Peter was crucified, and the tomb of Palestrina, famous early Italian composer. In his investigations, which were conducted at the request of Vatican authorities, he detonated small charges of dynamite and measured the time it took pressure waves to travel through the ground to a seismograph. From the readings, he deduced that there is at least one room under the area examined. The cathedral is known to have been erected on the site of a pagan cemetery that dated back to Nero's day.

* * *

Manganese Reclaiming Process

Manganese, in which our nation is poor, is essential for steel making and every possibility of increasing our supply of it is being explored. The slag that is discarded from open-hearth furnaces contains appreciable quantities of the metal and is, consequently, under investigation by the Bureau of Mines. In the laboratory, slag containing eight to ten percent manganese has been upgraded in a blast furnace to an iron-manganese combination containing 20 percent of the latter metal and also considerable phosphorus. Next, by placing the material, which is known as spiegeleisen, in a basic-lined converter and blowing compressed air through it, the researchers produced a slag containing 50-55 percent manganese and only 0.1 percent phosphorus. It is now proposed to charge this product into a second blast furnace, with the expectation of obtaining a standard 80-percent ferromanganese.

The hope is that in addition to producing a valuable steelmaking material, the byproduct phosphorus-rich slag can be ground up and put to work as a commercial fertilizer. It is reported that there is a sufficient supply of this manganese-bearing open-hearth slag to yield up to 400,000 tons of 80-percent ferromanganese per year. That is about 50 percent of the nation's requirements.

EXIT
Bill Bobb

* * *

Pluto's Steam Plant

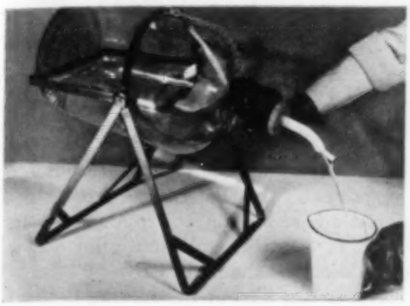
In Italy's Laradello Valley, some 40 miles south of Florence, circulating ground water comes in contact with hot volcanic lava and is vaporized. Bored holes tap the underground reservoirs, permitting the steam to be harnessed for driving turbine-generators. Exploitation of this resource began many years ago and by 1944 installed generating capacity was up to 800 million kw-hrs per year. However, the retreating Germans destroyed many of the facilities and complete reequipping was necessary. This has been done largely with Marshall Plan funds from the United States.

Steam now rises through 140 drilled holes and more outlets are being put down. Some penetrate 7000 feet, but most of them are between 1000 and 2000 feet deep. The Laradello generating stations have a combined capacity of nearly 2000 million kw-hrs annually and facilities for an additional 150,000 kw are planned. Two-thirds of the power is used by the Italian State Railways, a quarter by industries and the remainder by the Laradello Works themselves, which are mostly engaged in processing chemicals contained in water brought up with the steam. Laradello is strategically located between northern and southern Italy and transmission lines carry the power in both directions.

After passing through the turbines, the steam is condensed and the water used to irrigate agricultural land. The activities at Laradello give steady employment to 1500 persons and at times there are up to 400 temporary workers.

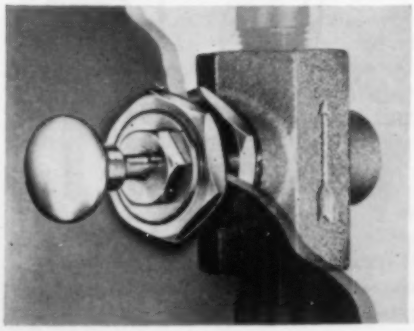
Industrial Notes

Dispensing liquids from large glass bottles into small containers is made safe and easy by use of the tilter and spout shown in the accompanying illustration. The supporting framework and cradle are of sturdy steel construction, and a metal chain holds the bottle in position when it is tipped for pouring. The spout is of acid-resistant rubber and has plastic tubing. It fits any-size bottle and has an air vent to insure smooth flow. The unit is manufactured by the General Scientific Equipment Company and is said to prevent spilling and splashing that may cause injury when handling corrosive fluids.

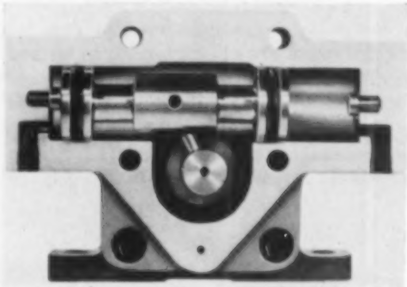


A lighter for service in automobiles uses vacuum from the manifold or windshield wiper to "draw" on a cigarette and get it going. We also read about a miniature compressor that pumps air into punctured tires while a car is in motion. It was shown at this year's model engineering exhibition in London, England. We don't know just how it's done without snarling up the delivery hose.

For use with air and gas lines where intermittent flow requires manual control there is available a self-closing push valve, a product recently introduced by King Engineering Corporation. The valve is opened by pressing a knob on the stem and closes automatically when pressure is released. It is sealed by readily accessible neoprene O-rings and, according to the manufacturer, has shown no leakage through the valve or around the stem during a breakdown test of one million operating cycles. Two styles are available: Model PV, which is pictured, for mounting on panels up to $\frac{7}{16}$ inch thick, and Model LV for in-the-line mounting. Inlets and outlets are tapped for $\frac{1}{4}$-inch pipe, and the rate of discharge is 25-30 cfm. Typical applications include hydrostatic gauges and other instruments that call for a manually controlled blast of air, single and multiple pressure test stands, blowing out or purging gas or air lines, and processing operations that need an occasional shot of gas or air.

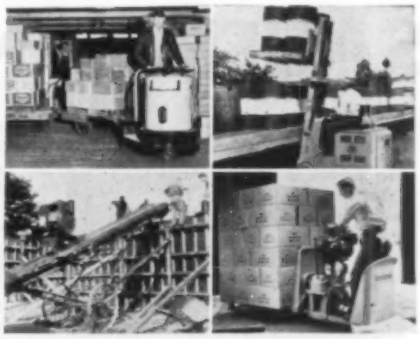


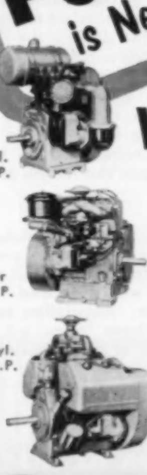
POV stands for power-operated valve, a recent product announced by Ledeen Manufacturing Company for the control of air, oil and water in services where hand- or foot-operated valves cannot be used. Essentially a standard 4-way unit, the disk is rotated by a piston moved by the pressure of the main-line operating fluid and controlled by small pilot valves. Pressure applied through the pilot on one end of the piston forces it ahead and turns the disk to the forward position; pressure exerted on the opposite end causes the piston to move back and rotate the disk to the reverse position. The power valves are available in six sizes with the choice of finger, toe, cam or solenoid-pilot control. They are designed for varied purposes such as automatic operation, where the movement of some part of a mechanism must start the valve to initiate another movement; remote control; reciprocating service, where the cylinder must travel back and forth continuously; and safety, where electric-power or line-pressure failure must reverse the valve.



The U. S. Bureau of Reclamation used compressed air to test the joints of 42-inch reinforced-concrete pipe laid on the Central Valley Project in California, but it got the air the hard way — with a bicycle pump. Connectors consist of rings with gaskets, one on each side.

Wherever Engine
POWER
is Needed...





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Because Wisconsin Air-Cooled Engines are supplied in a complete power range, from 3 to 30 H.P., in 4-cycle single cylinder, 2- and 4-cylinder types, there is an ideal size to fit all types of machines and power applications within this range, without wasted power and with maximum power service benefits. Heavy-duty construction, combined with extremely compact design and light weight are added advantages—and dependable AIR-COOLING permits trouble-free service under all climatic conditions.

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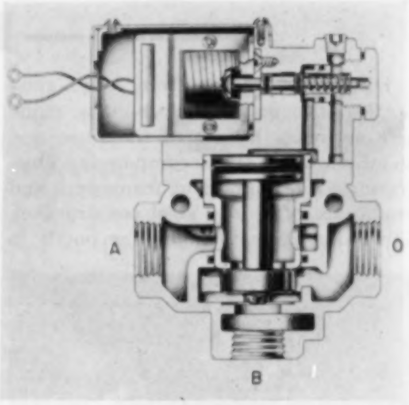
For testing, a man entered the pipe, put some water in the space between the gaskets and then applied air until it reached the pressure for which the line was designed. Any leakage appeared on the outside of the pipe and could be corrected before the pit was covered.

Adaptability, simplicity and ease of maintenance are characteristics claimed by Hannifin Corporation for its new Pilot-Master valve for the directional control of air pressure. The main valve section can be operated either 2- or 3-way normally open or normally closed to pressure without any internal change because the inlet and exhaust ports are interchangeable. In the accompanying cross-sectional view, Port A is the inlet for normally closed operation and the exhaust for normally open use; Port B is the inlet for normally open and the exhaust for normally closed service. Insertion of a pipe plug in the "exhaust" of either A or B converts the valve for 2-way use. In any case, Port O is the outlet to an air cylinder. The main valve is pressure operated through a piston-type poppet which fits in a removable cartridge that acts both as the cylinder for the piston and as the upper seat for the poppet. The cartridge can be replaced by removing the pilot head in which is a 3-way solenoid pilot valve which controls the main valve by admitting pressure into or exhausting it from the chamber above the piston. The pilot valve is also a poppet in that its stem is actuated by the plunger of the solenoid and returned by a lightly stressed spring. The Pilot-Master valve will shift in less than 1/20 of a second, it is claimed, on 60-cycle current. It can be supplied with a d-c solenoid. The valve is available in five sizes from ⅜ inch through 1¼ inches (inside pipe diameter).



After two years of testing, Galvanite Corporation has placed on the market a compound for the protection of steel and iron surfaces that is said to be equal and in many cases superior to conventional galvanizing processes such as electroplating, hot dipping, cementing and painting. Called Galvanite and applied cold, it leaves a coating, says the manufacturer, that is 96 parts, by weight, chemically pure zinc. This combines with the base metal and not only prevents corrosion, electrolysis and marine

MOVE MORE YARDAGE...

at less COST!

Hill of volcanic ash 250 ft. high is moved by 3 cu. yd. Sauerman Scraper which loads the material into cars using a simple ramp.

Big Excavations Handled in One Operation by a

SAUERMAN SCRAPER

In far northern Alberta, Canada, valuable tar sands are dug from a river bluff by a 1 cu. yd. Sauerman scraper.

In the Andes mountains, a Sauerman scraper digs gold-bearing gravel which it bulldozes into a sluice-way.

Many difficult dig-and-haul jobs, such as the three illustrated here, are reduced to simple terms and big savings effected by use of a Sauerman Drag Scraper Machine.

An exclusive feature of the Sauerman Machine is the unique Crescent bottomless scraper bucket. Because of its streamline design, the "Crescent" penetrates hard materials with the ease of a plowshare, gathers a full load in a few seconds, then rides its load to the dumping point where it makes an instantaneous, clean dump. Twenty to forty or more heaping loads moved per hour, the exact number of round trips of the scraper bucket depending upon the length of the operating span.

The operator, sitting in a comfortable control station, easily guides the scraper over a large area. Automatic shifting of the tail end of the machine is provided where desired. Power requirement is moderate. Installation and upkeep costs are low. Sizes from ⅓ cu. yd. to 15 cu. yd. cover the needs of all material handling jobs—large or small.

Write for new illustrated Catalog A.

Rope Haulage
Equipment
Specialists
Since 1909

SAUERMAN BROS., Inc.

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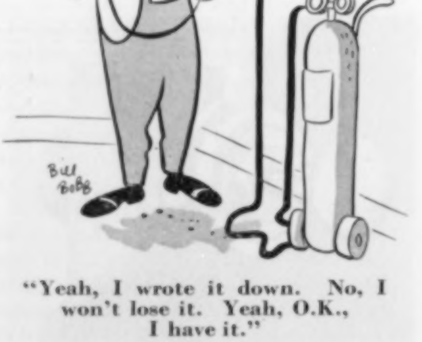
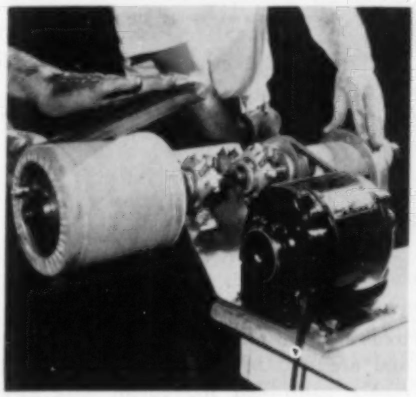


"Yeah, I wrote it down. No, I won't lose it. Yeah, O.K., I have it."

growths but also checks rusting when spread on corroded surfaces. Within 48 minutes after application the compound is dry and the material ready for use.

Production is soon to start in a Rutland, Vt., plant on a new insulating material developed by the Samica Corporation for the electrical industry. It is made of mine waste and scrap mica and will be turned out in continuous sheets on a special papermaking machine.

Inflatable cylindrical sleeves for sanding machines facilitate rounding sharp edges by permitting the work to be pressed into the yielding surface and enable the machines to perform some operations on irregular shapes that have previously called for hand sanding. The pneumatic sleeves are made by Hickory Hill Manufacturing Company in five diameters ranging from 2 to 6 inches, all 7 inches long. Each is equipped with an ordinary tire-type valve for inflation with a hand-operated pump. The sleeves fit on drums that are revolved by any available means.



The appliances are suitable for working on wood, plastic, or metal, all of which can be ground, buffed, or polished by choosing the proper grit. The degree of inflation is varied in accordance with the material handled. Recommended speeds are 1200 rpm for wood and plastic and up to 1400 for metals.

Six years ago the nonprofit organization CARE was formed in New York to handle the shipment and delivery of gift packages to needy people overseas. It began with food, then broadened the list to include textiles, books, and tools. The latest tool kit, priced at $20, is for young carpenters' and joiners' apprentices in western Germany whose parents haven't the funds to get them started in their chosen trade.

Motor cars of the future may have built-in windshield de-icers. It is reported that scientists of Britain's National Physical Laboratory have developed a process by which a transparent film of gold can be sandwiched between

THE VICTAULIC® METHOD OF PIPING

VICTAULIC
VICTAULIC

EASIEST WAY TO MAKE ENDS MEET

"VIC"
VICTAULIC

The VICTAULIC METHOD is a *complete* line of Victaulic Couplings, Full-Flow Fittings and Vic-Groover Tools for mechanical piping construction. It's the easy way to hook-up pipe . . . it's fast and versatile . . . it's *complete and all-inclusive!* Use the VICTAULIC METHOD and you streamline piping . . . cut costs!

The Easy-to-use Victaulic Coupling . . . world-famous for quick, leak-proof connections . . . is the basic element of the VICTAULIC METHOD. For use with this coupling, Victaulic offers a complete line of top efficiency Full-Flow Elbows, Tees, Reducers and other Fittings . . . PLUS Vic-Groover Tools for preparing pipe ends easily and quickly right on the job!

Mis-alignments, expansion and contraction are automatically taken care of by Victaulic, locked-joint, leak-tight piping is assured. For new construction, repairs or alterations . . . for any piping job, big or small, the VICTAULIC METHOD *is the easiest way to make ends meet.*

The name VICTAULIC is more than a trademark . . . it stands for world leadership in a speedy, dependable piping method . . . backed by unexcelled engineering and years of proved experience. FOR YOUR OWN PROTECTION . . . be sure you get VICTAULIC!

Write today for Victaulic Catalog & Engineering Manual No. 44-8B

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Telephone: Elizabeth 4-2141

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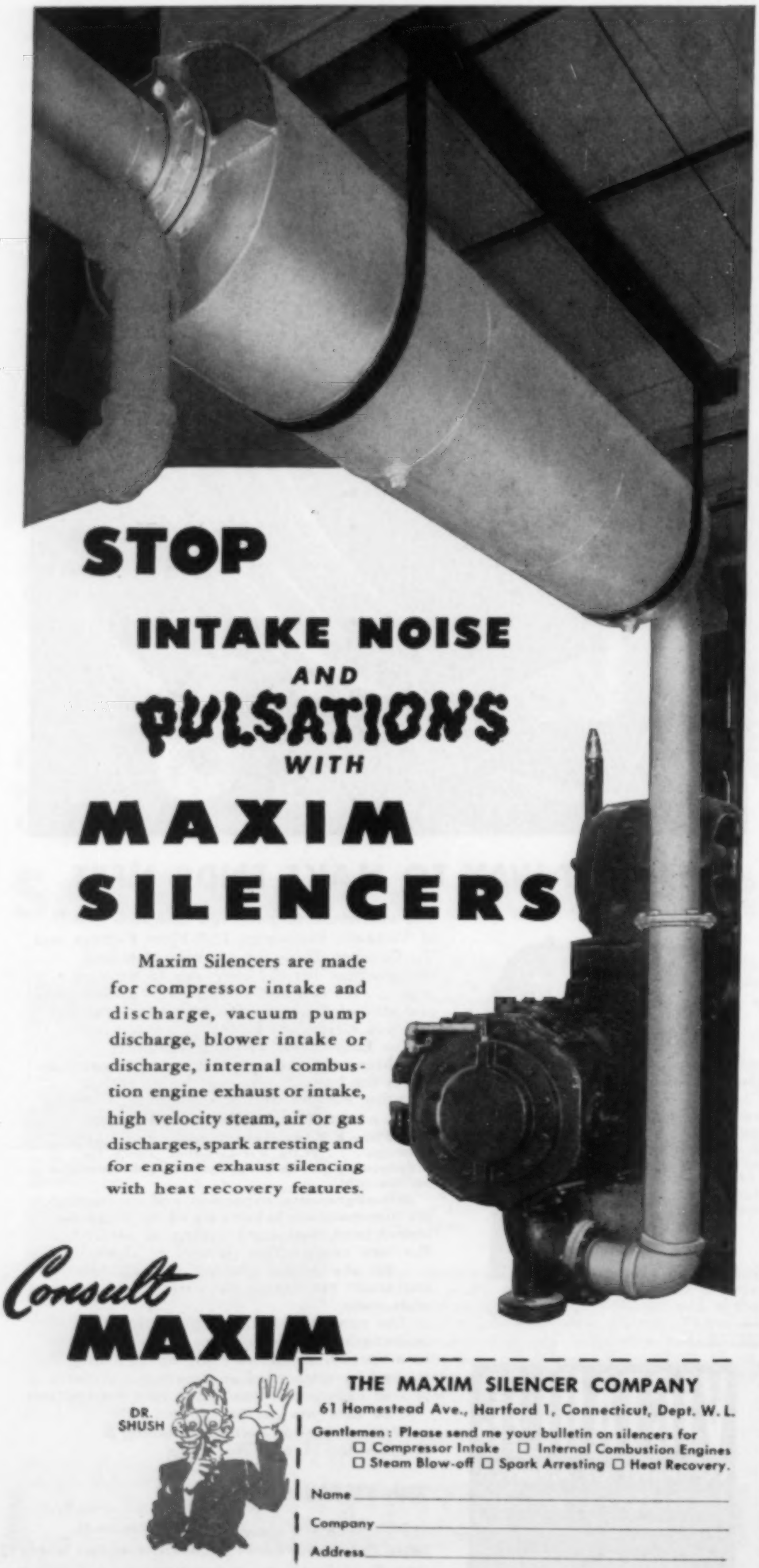
28th VICTAULIC YEAR

California: Victaulic Inc., 727 W. 7th St., Los Angeles 14
Canada: Victaulic Co. of Canada Ltd., 406 Hopewell Ave., Toronto 10
Export: Pipe Couplings, Inc., 30 Rockefeller Plaza, N. Y. 20, N. Y.



STOP INTAKE NOISE AND PULSATIONS WITH MAXIM SILENCERS

Maxim Silencers are made for compressor intake and discharge, vacuum pump discharge, blower intake or discharge, internal combustion engine exhaust or intake, high velocity steam, air or gas discharges, spark arresting and for engine exhaust silencing with heat recovery features.

Consult MAXIM

DR. SHUSH

THE MAXIM SILENCER COMPANY
61 Homestead Ave., Hartford 1, Connecticut, Dept. W. L.

Gentlemen: Please send me your bulletin on silencers for
☐ Compressor Intake ☐ Internal Combustion Engines
☐ Steam Blow-off ☐ Spark Arresting ☐ Heat Recovery.

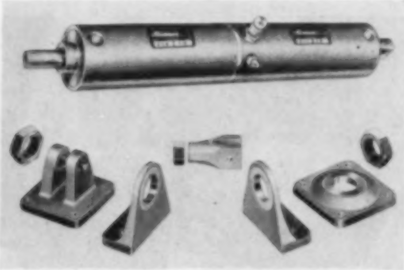
Name ____________________

Company ____________________

Address ____________________

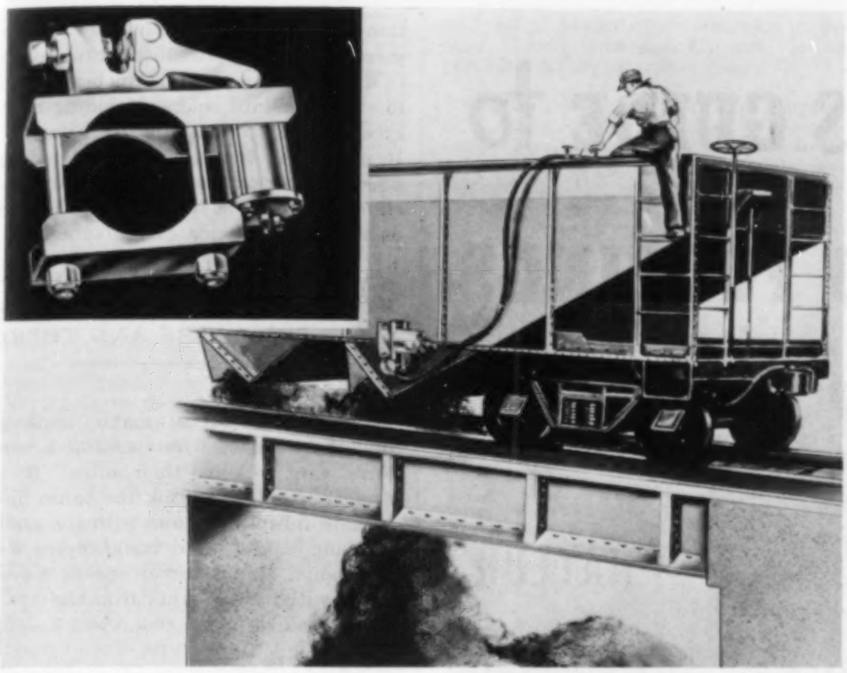
layers of glass to insure unobstructed vision in cold weather. The yellow metal, an excellent conductor of electricity, will keep the windshield warm and thus melt snow and ice. Something similar was tried earlier with metal oxides but with less success. Questioned as to cost, the scientists said the film of gold is not expensive because it is only one-quarter of one-millionth inch thick.

Modernair Corporation has announced the addition of a new air-hydraulic cylinder to its line of industrial pressure-operated devices. It is designed to use standard shop air-line pressure and has a built-in hydraulic system with an adjustable speed control. It is at present available in two bore sizes, 2 and 3 inches (others made to order), featuring interchangeable mounting brackets and a flush exterior that permit installation in any position and in restricted spaces.



The cylinders are suitable for powering tools or work in process of machining and are said to insure rapid traverse, nicely controlled movement and fast reverse action.

To short-circuit the electrolytic action that attacks 410 and 416 chrome-steel valve stems after hydrostatic tests, Crane Packing Company has developed a new packing, designated as Style 187. The latter embodies a special sacrificial metal that is said to sidetrack electrolysis and the pitting action that would otherwise occur during the period between testing and actual valve use. The packing is braided of pure asbestos yarn around a resilient graphite and asbestos core and is impregnated throughout with an antifrictional dry-graphite lubricant. It is designed for use with steam valves



For vibrators required temporarily to facilitate the transfer of certain bulk materials from carriers, Viber Company has developed an air-operated clamp that makes it possible to attach and detach the units and to shift them from one car or truck to another in a matter of seconds, it is claimed. It consists of two metal jaws that securely grip any suitable steel angle or other member when air is admitted to a small pneumatic cylinder, which is an integral part of the clamp, as the insert in the accompanying picture shows. A single line with a "Y" connection feeds the air to the cylinder and to the vibrator. Pressure on the jaws is maintained by air power for short unloading periods, but when a vibrator is to function for a considerable length of time, the clamp can be secured by bolts and the use of air eliminated. Pneumatic vibrators for which the clamp was designed have found wide application in foundries and in the ceramic, cement, coal and food-processing and other industries.

at temperatures up to 850°F and pressures to 2000 psi. It can be die-formed into any desired shape and size.

Labelon is a recently developed pressure-sensitive plastic tape you can write on with pencil, dry ballpoint pen or stylus. It may be applied to bottles, salesmen's samples and tool bins—to anything, in fact, that offers a smooth surface—and is said to be resistant to smudging, dirt, oil, water and acids; unaffected by temperatures from minus 40 to plus 160°F; and to peel off easily when no longer required. The tape is made in many different colors, widths and roll lengths with suitable dispensers by Labelon Tape Company, Inc., 450 Atlantic Avenue, Rochester 9, N. Y.

"He's a good man, but when he's got a hangover he just can't follow a straight line."

Insulating paper made of quartz has been produced in the U.S. Naval Research Laboratory and may be used for some purposes as a substitute for asbestos insulation. It resists temperatures up to 3000°F and is free of boron, properties that make it suitable for insulating electric cables and for service in atomic-energy power plants. Full information about the material is contained in Release 344-52 obtainable from the Department of Defense, Office of Public Information, Washington 25, D. C.

Sashlights of Resolite—a translucent, shatterproof material made of polyester resins and Fiberglas—are recommended for industrial plants, especially where breakage of glass panes through vibra-

LE-HI Makes a Good Connection TOO!

Specify LE-HI for all Hose Couplings!

Wherever hose is used there is a LE-HI hose coupling to match—from small tubing to large industrial applications.... The complete LE-HI line includes:

- **Air Tool Couplings**
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- **Acid Hose Couplings**
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SERIES 400

- **Drilling Hose Couplings**
- **Oil and Gas Hose Couplings**
- **Agricultural Hose Couplings**

. . . plus complete lines of hose clamps, air valves and manifolds.

SERIES 650

Sold through leading distributors and rubber manufacturers only.

"Old Doc" says: "Write now for your free copy of the complete LE-HI catalog"

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COMPANY
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HIGH and LOW PRESSURE
HOSE COUPLINGS
TRADEMARK REGISTERED

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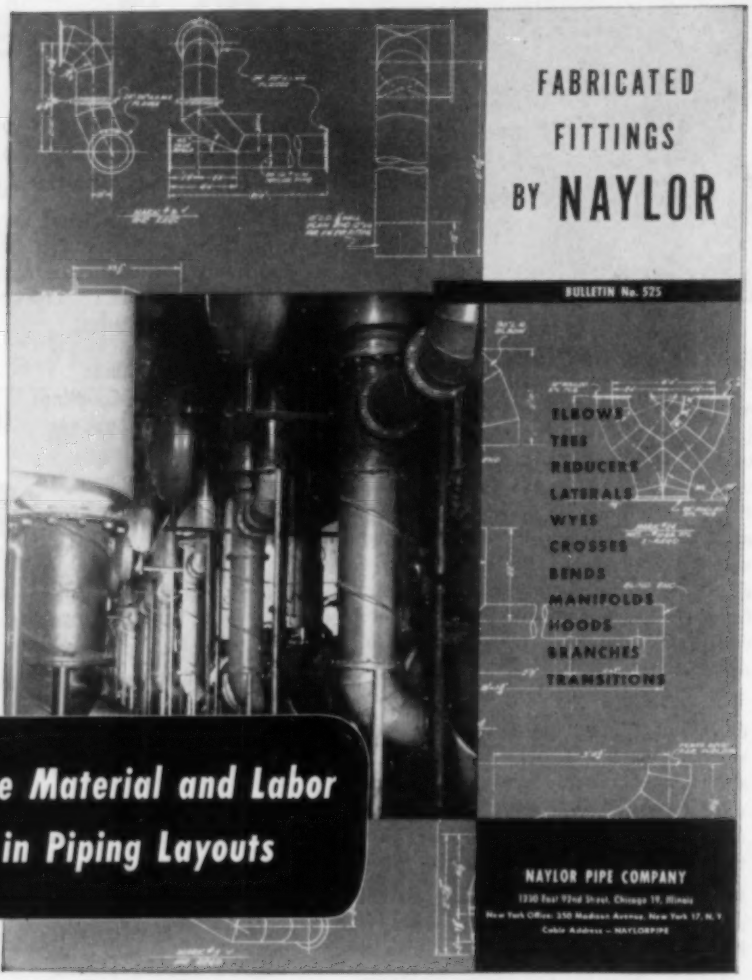
FABRICATED FITTINGS



FABRICATED
FITTINGS
BY NAYLOR

BULLETIN No. 525

ELBOWS
TEES
REDUCERS
LATERALS
WYES
CROSSES
BENDS
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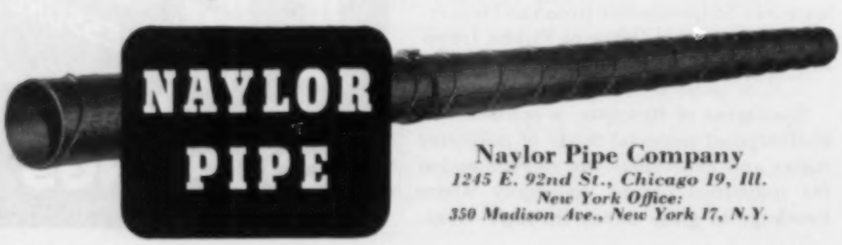
HOODS
BRANCHES
TRANSITIONS

NAYLOR PIPE COMPANY
1230 East 92nd Street, Chicago 19, Illinois
New York Office: 350 Madison Avenue, New York 17, N. Y.
Cable Address — NAYLORPIPE

Save Material and Labor
in Piping Layouts

Write for this helpful bulletin on Naylor Fabrication Service. It presents data on standard and special fittings for lightweight pipe and offers practical ideas to simplify piping layouts. Included are special fabrications to save time, material and labor through eliminating numerous flanged joints and combining many fittings into one integral unit. Ask for Bulletin No. 525.



NAYLOR
PIPE

Naylor Pipe Company
1245 E. 92nd St., Chicago 19, Ill.
New York Office:
350 Madison Ave., New York 17, N.Y.

tion or other causes is a factor. It is manufactured by Resolite Corporation in flat sheets up to 42x96 inches in size in eight standard colors, including light green which is best suited for windows. It is claimed that the material is not affected by moisture and that it withstands extreme heat and cold and the normal run of acids and alkalies.

QUOTES

—FROM HERE AND THERE

Drive-in Bank

"Pneumatic tubes make banking quicker and easier for customers who don't want to leave their autos. At a Bridgeport, Conn., bank the tubes link drive-in tellers' windows with the main checking, savings and bookkeeping departments; compressed air speeds deposits and withdrawals to and from the cars."

Wall Street Journal, June 5, 1952

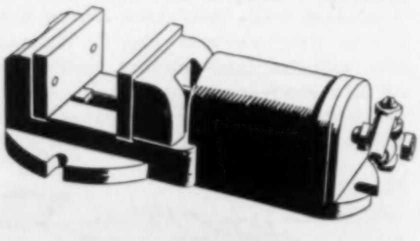
Air-jetting Poles

"Several line construction contractors have set wood power-line poles in wet and sandy locations with the aid of air jets. They report that there must be sufficient water in the hole for the air to stir up and puddle the soil. If the pole is rocked back and forth, it will sink gradually to the desired depth. This air-jet method cannot be used where extra hard soil or hardpan is encountered."

W. L. Pilsbury, Florida Power Corporation, St. Petersburg, in Electrical World of June 30, 1952

Pneumatic Vises

"Air-operated vises are used quite widely, since most shops are equipped with the necessary air compressors and piping to service them. Actuated either by hand control or foot treadle, they have a number of advantages over hand-powered vises. Clamping is swift, firm, and uniform, and the movable jaw can shift to gripping position in one motion. Vises develop clamping pressure of several tons from a line pressure of only 100 pounds. Jaw area is kept to a minimum, exposing a greater work surface to the action of processing tools. From a maintenance standpoint, air-operated vises are easy to take care of, since elimination of excessive clamping pressures means less wear on working parts."



From an article, Use and Care of Vises, Mill & Factory, June, 1952

Industrial Literature

Barksdale Valves, 1566 E. Slauson Avenue, Los Angeles 11, Calif., describes its complete new line of Shear-Seal solenoid valves in Catalogue 1B-2 now available upon request. The series consists of shutoff 2-way diverter and 3- and 4-way selector valves for air, water or oil service and comes in three pressure-range groups from 0 to 3000.

Federal Machinery Company, 134 Grand Street, New York 13, N. Y., offers sheet-metal fabricating shops a 32-page catalogue of its standard punches and dies of various types for hand, foot, and power presses. Punch and die adaptors and die shoes also are described and illustrated. The booklet was compiled principally as a guide to facilitate ordering. For a copy address the company's Sales Department.

Gear shapers are the subject of an 8-page illustrated bulletin obtainable from Michigan Tool Company, 7171 E. McNichols Road, Detroit 12, Mich. Latest applications of the company's improved line of Series 1800 Shear-Speed radial shapers and of a new model are covered, as well as specifications, design changes and typical shapes that can be produced by them. Ask for Bulletin No. 1800-52.

The 1952 edition of *Wheelco Data Book and Catalog*, a 32-page publication, is now available upon request. It contains prices, application recommendations and pertinent information about instrument sensing units and accessories made by Wheelco Instruments Division, Barber-Colman Company, Rockford, Ill. Designated as Bulletin TC 9, it is a valuable asset in applying indicating, controlling and recording instruments.

Minneapolis-Honeywell Regulator Company is distributing a catalogue describing its recording or indicating circular-case electric-control thermometers for regulating the temperature of drying ovens, lumber kilns, plating tanks and cooking vessels. Other pertinent information also is included. Write to the company at Station 40, Wayne and Windrim Avenues, Philadelphia 44, Pa., for Catalogue 6482.

In a 4-page brochure (52-401) The DoALL Company, Des Plaines, Ill., describes its new indexing attachment for surface grinders that permits grinding cylindrical and angular forms. The attachment features a built-in 2-way sine-bar tilt arrangement that simplifies setting taper angles with gauge blocks which eliminate guesswork. Illustrations show the many setups possible with the attachment.

The Garlock Packing Company, Palmyra, N. Y., is distributing an 8-page bulletin outlining the advantages of its Lattice-Braid rod packing. In addition to sectional drawings showing the unique structure of the packing, the publication contains specifications and broadly indicates the types to be selected for varied services. Copies of *Garlock Lattice-Braid* are available by writing to the company.

Those with gauging problems may be interested in a 38-page illustrated booklet, titled *Dimensional Control and Gaging Policy*, published by The Sheffield Corporation, Dayton 1, Ohio. It covers such subjects as tolerances, reference temperatures, ordnance practices, instruments, fixed gauges and multiple semiautomatic and automatic gauging devices. Anyone interested can obtain a single copy without charge by writing to the Company.

A new piece of informative literature is offered by Allis-Chalmers Manufacturing Company, 1000 S. 70th Street, Milwaukee, Wis., on the new Magic Grip bushing for its stationary-control, wide-range Vari-Pitch sheaves. The new bushing is said to make for quick and easy installation and removal of sheaves from shafts and, as compared with the old style, has reduced the weight of the sheave-and-bushing assembly about 20 percent.

Acme Salvage Co.
Hal Money

"The knot is to remind me to bring up the diver in an hour."

Donaldson Field Engineers

Cover the Continent

on your Air Cleaner and Muffler Problems!

These men are on *our* payroll, but they work for *you*. Their job is to make sure that *your* equipment stays properly protected against dust, or that Donaldson Mufflers continue to do their job. Highly unusual conditions of climate, dust or geography that create problems requiring on-the-spot study, take them to every corner of the continent.

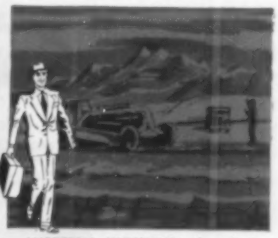
Donaldson Field Service is an important part of the Donaldson Engineering Program. It is included in the Donaldson "follow-through-service" package which starts with an analysis of your air cleaner or muffler requirements and continues throughout the operating life of your equipment.

DONALDSON COMPANY, INC.

666 Pelham Blvd., St. Paul 4, Minnesota
Donaldson Co. Ltd. (Canada), Chatham, Ontario

IRON MINE — Donaldson engineers developed a new, quieter, long-life muffler for ore trucks.

WHEAT FIELD—Installed pre-screener to eliminate entrance of chaff to induction system.



WESTERN HIGHWAY—Installed larger cleaner to handle over-run condition.

Donaldson AIR CLEANERS MUFFLERS

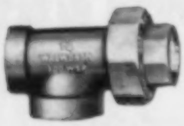
Pressure-Seal Cast Steel Gate Valve

Small Cast Steel Angle and Y-Globe Valves for high-pressure service

Walseal Bronze Strainer

Walseal Bronze Globe Valve

Walseal Bronze Elbow



Walseal Bronze Union End Tee

Walworth is proud to be aboard the S. S. United States

When the United States Lines, the Newport News Shipbuilding & Dry Dock Company, and Gibbs & Cox, Inc., naval architects, join forces to build the fastest, safest and most modern liner the world has ever seen, the selected materials and components have to be top quality. Walworth Pressure-Seal Cast Steel Gate, Globe, and Angle Valves, and Walworth Small Cast Steel Angle and Y-Globe Valves for high-pressure service are installed in the main steam lines of the S. S. United States. Brass and copper lines use large numbers of Walseal valves, fittings, strainers, and unions.

Knowing that Walworth valves and fittings are a vital part of the power arteries aboard this great ship, the proudest moment of Walworth's 110 years of manufacturing experience came when the new Queen of the Sea broke both the east and west trans-Atlantic speed records.

As we present our compliments to Commodore Manning and his crew, to the Newport News Shipbuilding & Dry Dock Company and its men, and to William F. Gibbs and his staff, we also compliment the men and women of the Walworth Company who gave of themselves to put quality into our products and this quality ship.

WALWORTH

valves • fittings • pipe wrenches
60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Now–two types of hose handle 95% of all air hose needs

Save days of waiting for special hose—save money, too

B. F. Goodrich makes an air hose for every purpose, but on the average two types of hose—Highflex and Type 50—are best for 95 to 99 out of every hundred air hose needs.

For general service—Type 50 is the most versatile hose made today. It's used for tie tamping, light and heavy portable compressors, air hoists, ore mining, quarry service and drills (left, above).

For hard-to-get-at-jobs where light weight and flexibility are so important, your best buy is Highflex. Weighing only half as much as ordinary air hose, Highflex is many times more flexible, making it easy to use in tight corners, easy to pull down a production line. Yet it has higher burst strength than heavy old-type hose of the same size. Especially designed for use with small shop tools (as shown at right, above), it's equally serviceable as welding hose, water hose, or even as a low pressure hydraulic hose.

Oil won't rot them—Both Type 50 and Highflex have tubes that won't break into loose, gummy particles to clog up tools. Their covers are oil-resisting, too. Can be dragged through oil or grease without damage.

Rough treatment won't tear them—Both types of hose have abrasion-resistant covers. Scraping over rock, rough floors, cinders or roads won't tear them. Won't check or crack from constant sunlight.

Saves waiting—B. F. Goodrich distributors have both Type 50 and Highflex for immediate delivery. Now there's no need to hold up production while waiting for special kinds of hose. For quick delivery the next time you need air hose, call your local BFG distributor or write *The B. F. Goodrich Company, Industrial & General Products Division, Akron, Ohio.*

Air Hose

BY

B.F. Goodrich

teamwork in specialties

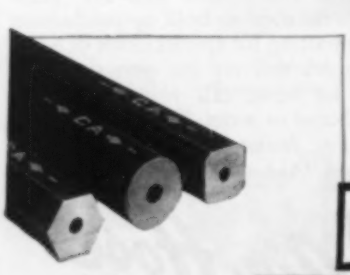
THE BLACKSMITH

Crucible Hollow Drill Rods

When the drill bit bites into rock, its hollow drill rod gets as many as 2500 wrenching impacts a minute. The blacksmith plays an important part in maintaining the quality of this steel. It's up to him to forge and temper it until it has exactly the right balance of surface hardness, toughness and fatigue strength. With Crucible Hollow Drill Rod, the blacksmith can count on getting this balance every time. For this drill rod is backed by Crucible's years of experience in specialty steel making.

Records of drilling operations prove Crucible Hollow Drill Rod's ability to take it. Service life is high; breakage and bit loss are at a minimum.

For long life and low maintenance, use Crucible Hollow Drill Rods.

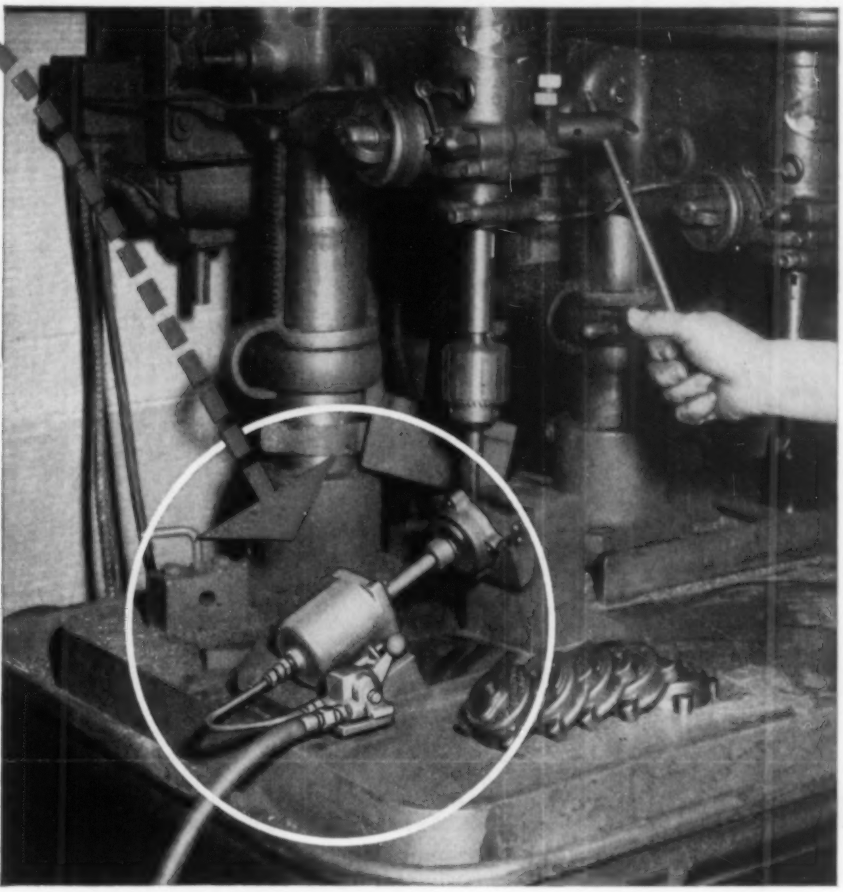


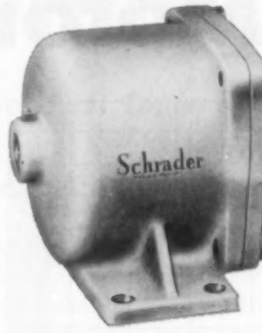
CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking **HOLLOW DRILL RODS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.
REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

Simplify any work-holding problem





ClampAir Cylinder

Watch a worker making ready for a simple drilling operation. He places the work in a fixture and hand-clamps it. With everything all set to go, you'll find he takes as much as ten seconds just to grip the work tightly in the clamp.

Multiply that by thousands of machining operations in a normal high production shop. You'll find a substantial portion of work time is used up before actual production is begun.

You can eliminate nearly all of this lost time with the new Schrader ClampAir. What's more, since the ClampAir takes no more effort than opening a valve, high-priced workers are not tired by useless labor.

The ClampAir is actually a bantam air cylinder, with plenty of power to hold work firmly in place—with the same holding force every time. That means the end of rejects caused by inconsistent holding forces.

The number of places where ClampAir can serve you well is on drill presses, milling machines, gluing operations, and others too numerous to mention. In all of these, production rates can be upped to higher percentage brackets with ClampAir. And, since ClampAir is basically a push type cylinder, it can be used in many other spots where you need a short, hard stroke.

It's easy to find out how ClampAir can shorten production time, increase worker efficiency. Write, outlining the applications in which you are interested—or fill out the coupon below. We will be glad to help you determine your needs.

Schrader
REG. U. S. PAT. OFF.

products control the air

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Air Cylinders • Operating Valves • Press & Shear Controls • Air Ejection Sets • Blow Guns • Air Line Couplers • Air Hose & Fittings • Hose Reels • Pressure Regulators & Oilers • Air Strainers • Hydraulic Gauges • Uniflare Tube Fittings

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Division of Scovill Manufacturing Company, Incorporated
478 Vanderbilt Avenue, Brooklyn 17, N. Y., Dept. W-5

I am interested in more information on..

Name________________________ Title________________

Company____

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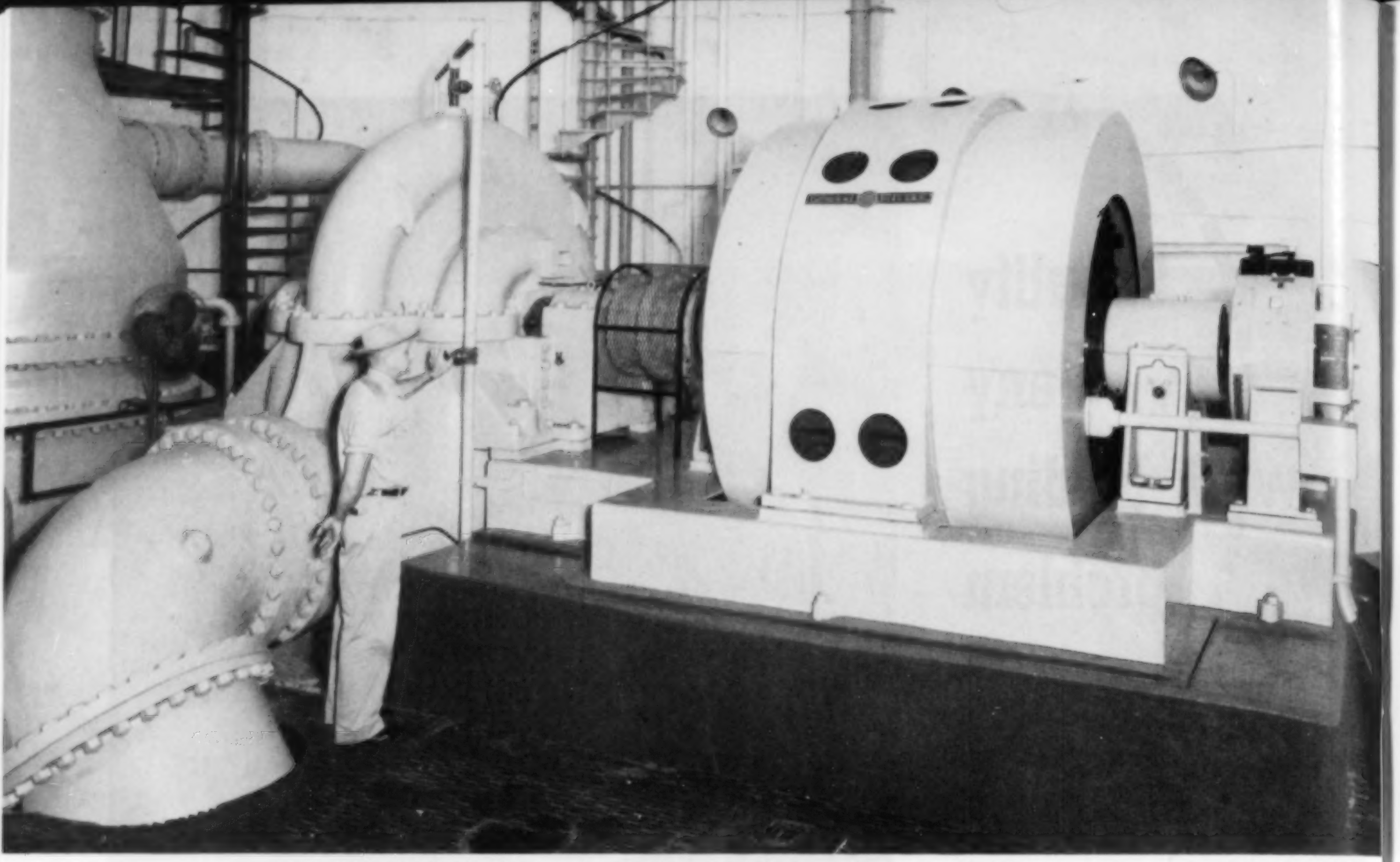
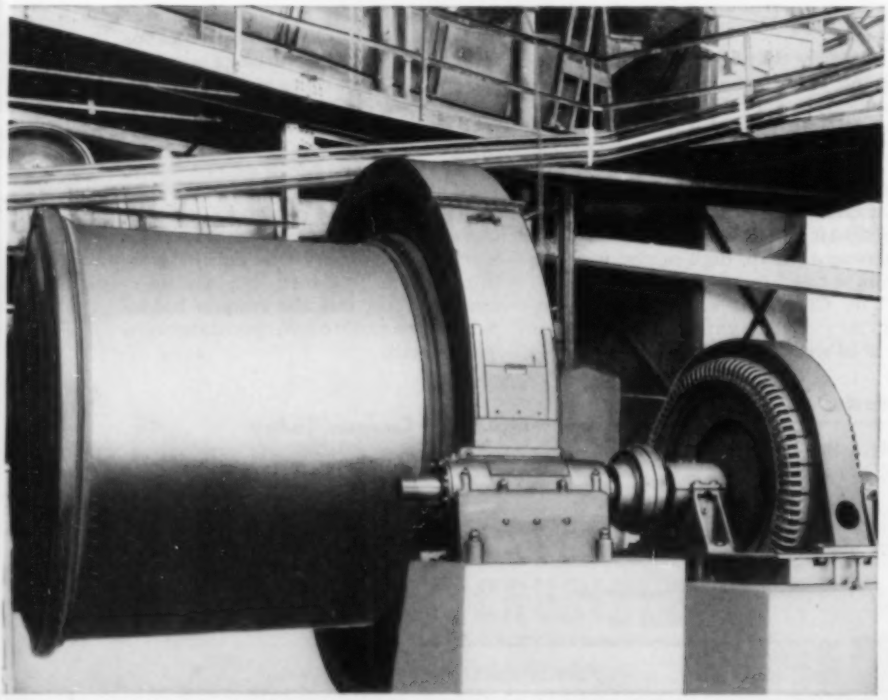
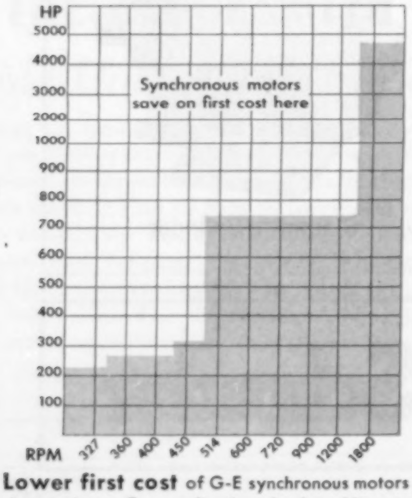


Savings in distribution equipment investment were made possible by selection of this General Electric 2500 hp synchronous motor for a municipal pumping station.

G-E Synchronous Motors

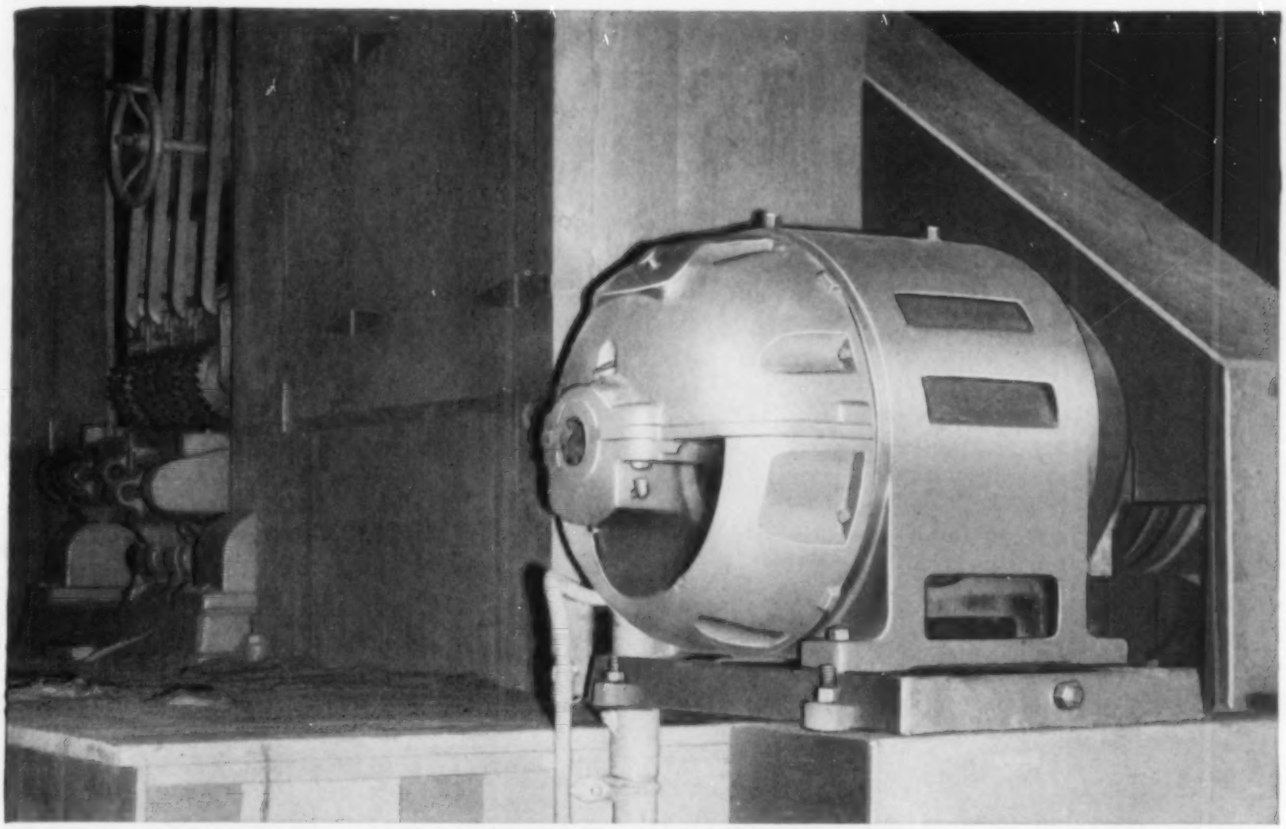


To meet the tough starting requirements of a ball mill, a mining company chose this G-E high-torque synchronous motor rated at 600 hp. Initial cost was low and the motor has given 20 years of dependable service.



Lower first cost of G-E synchronous motors is shown above. For applications in the white area, synchronous motors cost less than any other kind of motor. Calculations below show power savings on a typical 1000 hp, 514 rpm motor.

Gain in efficiency over other types of motors at same rating	**2.2%**
Hourly saving at power rate of $0.01 per/kwh	**$0.184**
Yearly saving (assuming constant operation)	**$1600.00**



Lower operating cost is the rule when General Electric Tri-Clad* synchronous motors are used with equipment such as this horizontal band re-saw, operating almost continuously at heavy loads.

Offer Double Savings

Lower First Costs, Lower Operating Costs Can Be Realized on Large, Constant-Speed Applications in Many Industries

Before you select a drive for a large equipment providing heavy and continuous service, be sure to investigate the economics of General Electric synchronous motors. On many applications such as pumps, compressors, fans, etc., outstanding savings are available.

LOWER FIRST COSTS

In most ratings where horsepower is equal to or greater than speed, the price tag on a synchronous motor with exciter and control is less than that of any other a-c motor with its control.

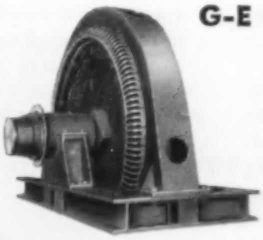
And, because a synchronous motor improves plant power factor, initial investment in distribution equipment frequently can be reduced. (The load which any new or expanded power system will carry is proportional to the plant's power factor.)

LOWER OPERATING COSTS

A synchronous motor usually has a higher full-load efficiency than any other type of motor, produces more work per dollar's worth of power consumed. Where loads are heavy and continuous, an advantage of from 0.5 to 3.0% in efficiency pays off.

Engineers with many years of field experience will tailor G-E synchronous motors and control to your job. Call in your General Electric representative—he'll be glad to discuss your particular application. And for more information on G-E synchronous motors, write for bulletins GEA-5332 (low-speed) or GEA-5426 (high-speed) to Section 770-26, *General Electric Company, Schenectady 5, N. Y.*

BE SURE TO SPECIFY G-E SYNCHRONOUS MOTORS



The result of more than 55 years experience in development, manufacture, and successful application, General Electric's line of synchronous motors is available in low speed and high speed types, engine-type and Tri-Clad* construction.

Numerous exclusive design and construction features promote long, dependable service. Get the full details!

Reg. trademark U.S. Pat. Off.

GENERAL ELECTRIC

770-26

"ANACONDA'S the best rod I've ever used! And I've tried 'em all."

—says Magnus Hansen, Shop Foreman and Welder for Brown Brothers Welding Shop, San Francisco

"I've been a welder a long time. Been with Brown Brothers 34 years. I know good rod. ANACONDA-997 (Low Fuming) Bronze Rod flows readily at low temperature. Work needs less preheating. This rod 'tins' easily. And it's easy to machine.

"We use ANACONDA Rods on many jobs. We do every kind of work—both oxyacetylene and electric. We've welded every kind of metal on everything from ships to toy tractors."

Good welders rely on ANACONDA Rods, available from distributors throughout the United States. When you face a tough welding job, contact your nearest supplier. Chances are he's an experienced welder himself, ready to help you. For information on welding techniques write for free booklet B-13. The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Ont.

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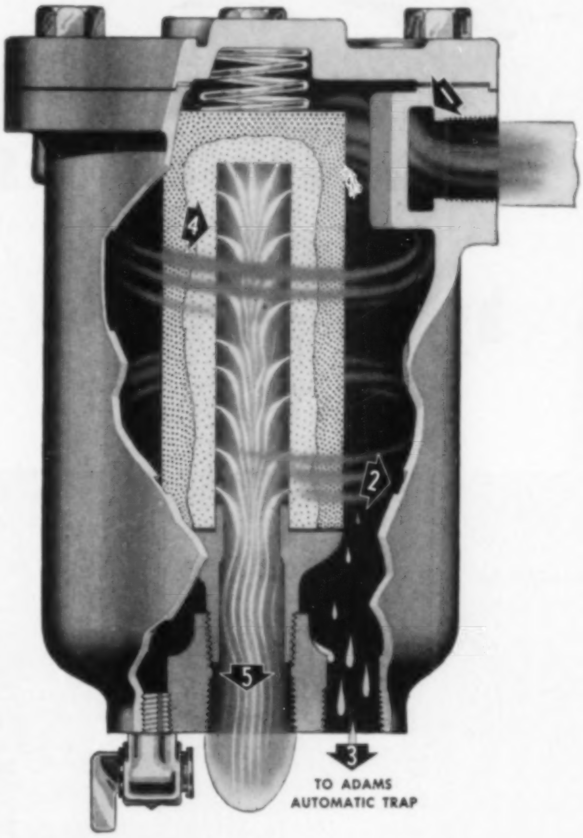
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5
3
TO ADAMS AUTOMATIC TRAP

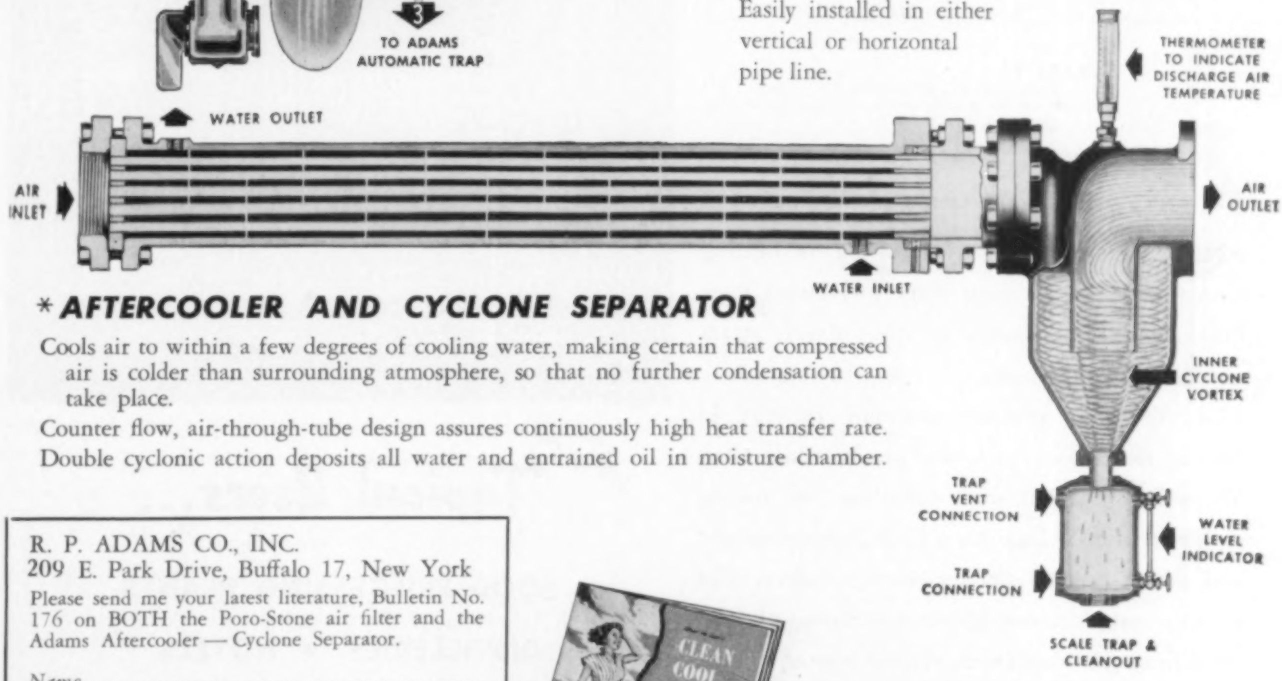
—— BOTH ANSWERS TO THE PROBLEM OF KEEPING WATER, WATER VAPOR, OIL AND DIRT OUT OF COMPRESSED AIR LINES

There's no *one* answer to this problem! The most expensive aftercooler you can buy will not remove scale that is picked up in the distribution lines. The most expensive air filter you can buy cannot guarantee removal of water vapor until it has been condensed by cooling. That's why Adams makes both.

* PORO-STONE *AIR FILTER*

1. Centrifugal separation of dirt and liquids.
2. Drainage to trap directed by vertical cast-in slots.
3. Continuous, fully automatic trap action.
4. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
5. Clean, dry air at practically unchanged pressure. Standard, stocked sizes handle from 10 to 700 cfm.

Easily installed in either vertical or horizontal pipe line.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TRAP CONNECTION
SCALE TRAP & CLEANOUT

* *AFTERCOOLER AND CYCLONE SEPARATOR*

Cools air to within a few degrees of cooling water, making certain that compressed air is colder than surrounding atmosphere, so that no further condensation can take place.

Counter flow, air-through-tube design assures continuously high heat transfer rate.

Double cyclonic action deposits all water and entrained oil in moisture chamber.

R. P. ADAMS CO., INC.
209 E. Park Drive, Buffalo 17, New York

Please send me your latest literature, Bulletin No. 176 on BOTH the Poro-Stone air filter and the Adams Aftercooler — Cyclone Separator.

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COOL
DRY
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TOOLS

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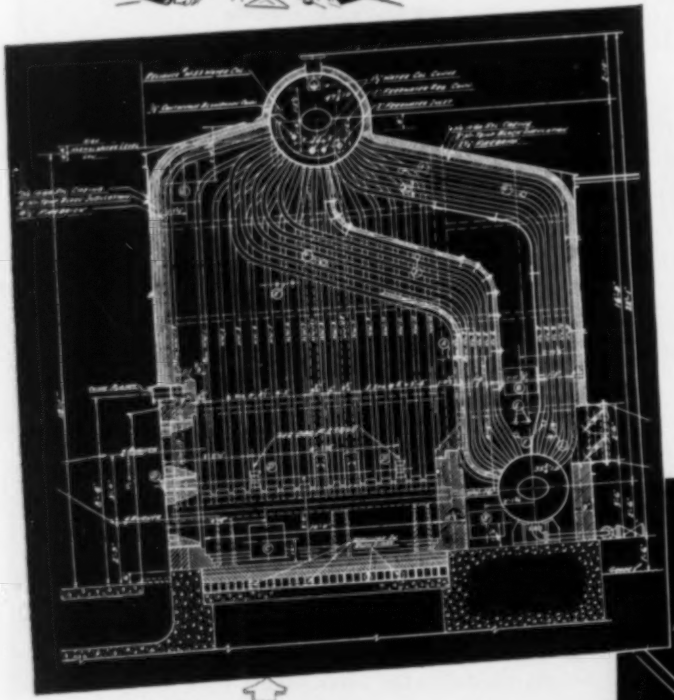
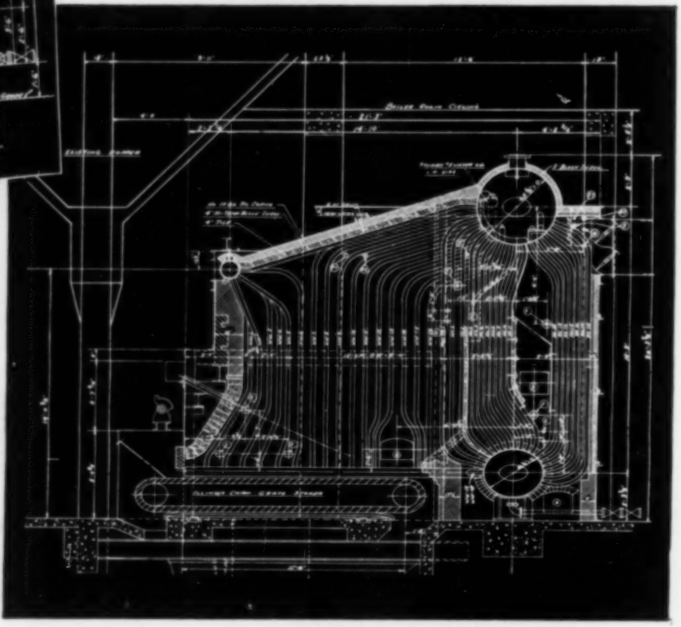
Industry Approved

Two-Drum STEAM GENERATORS by Vogt



CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



CLASS VS
The Seelbach Hotel, Louisville, Ky. is served by this 30,000 pounds steam per hour boiler.

A wide variety of industrial plants and other users of steam for power, processing, or heating have found these efficient Vogt Two-Drum Type Boilers to be the answer to their diverse steam generating requirements.

Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

Typical Users...

FOOD PROCESSING PLANTS
DISTILLERIES • HOTELS
HOSPITALS • CHEMICAL PLANTS
PETROLEUM REFINERIES

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LEAK-PROOF, Minimum Wear Locking Device

Integral Factory-Assembled Tamper-Proof Socket Head

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Locking pins in Hansen Push-Tite Coupling Socket afford large area contact with plug, thereby preventing wear and subsequent leakage.

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QUICK CONNECTIVE FLUID LINE COUPLINGS *for*
AIR • OIL • GREASE • HYDRAULIC FLUIDS
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REFRIGERANTS • GASOLINE • COOLANTS

● The ability of Hansen Push-Tite Couplings to withstand severe service — with practically no maintenance — has been thoroughly proved by years of hard everyday use in thousands of plants. The "socket head", which contains the locking device, is factory assembled into a rugged integral unit which cannot be readily injured or have component parts lost by casual tampering.

To connect the coupling, you merely push the plug into the socket with one hand. Flow is instantaneous. To disconnect, push back sleeve on socket — coupling disconnects. Flow is shut off instantly and automatically.

Write for catalog giving complete range of types and sizes.

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Here are some of the samples of explosives taken daily at one Hercules plant. Every day, at every plant, samples of each lot are analyzed and tested for conformity with Hercules' strict chemical and physical standards.

Sensitivity, consistency, water resistance, moisture content, density, percentages of various ingredients . . . these are some of the exacting laboratory inspection standards that must be met.

From raw materials to packaged products, Hercules' progress in explosives assures better blasting performance and helps to lower blasting costs.

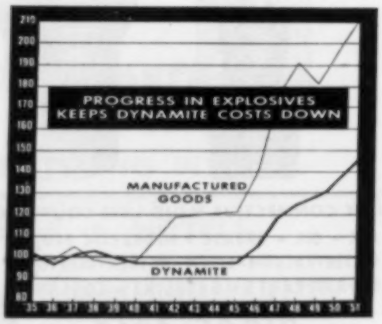


Chart shows relative stability of dynamite prices since 1935, as compared with prices of other manufactured goods. 1935-39 values=100.

HERCULES POWDER COMPANY

INCORPORATED

Explosives Department, 932 King St., Wilmington 99, Del.

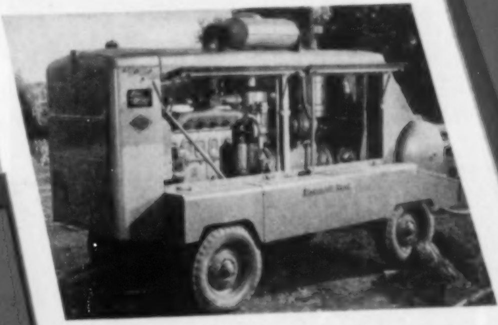
XR52-6

GM DIESEL CASE HISTORY No. 516-2

USER: Mancini-Miller-Thompsen Co., East Detroit, Michigan

INSTALLATION: GM 6-71 Diesel, powering an Ingersoll-Rand Gyroflow 600 cfm compressor, which supplies air to a McKierman-Terry 9B3 double-action hammer.

PERFORMANCE: GM Diesel engine in this compressor does the work of two engines powering 500 cfm compressors formerly needed to drive hammer. Fuel costs are halved. GM Diesel saves 15 minutes starting time.



THIS DIESEL TAKES THE PLACE OF TWO

and cuts costs in half

Here's another application where the compactness and high-speed power of General Motors 2-cycle Diesel engines save money for contractors. With power on every piston downstroke, instead of every second downstroke as in 4-cycle engines, a GM Diesel delivers plenty of smooth, steady power. It gets more work done in less time because it accelerates faster. It starts at the push of a button and is easy to operate and maintain. Compactness of this power-packed engine enables it to fit in about the same space as gasoline engines of comparable power—providing savings of 40% to 70% on fuel and maintenance. See your GM Diesel distributor or write us for full information.

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Write for booklet "A 50,000,000 Horsepower Insurance Policy" that tells you why.

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GENERAL MOTORS • DETROIT 28, MICHIGAN
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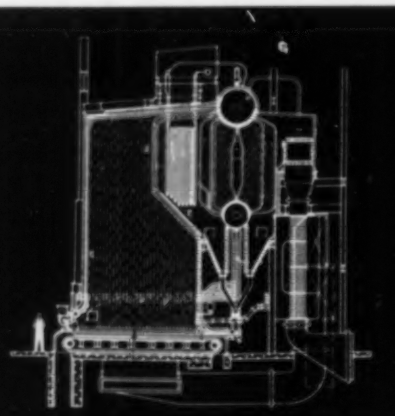
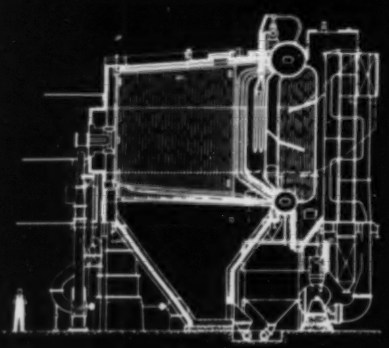
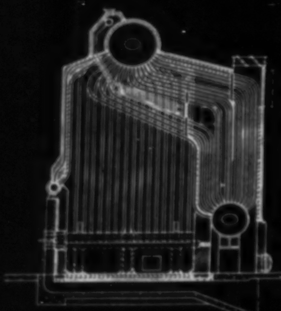


VU-40 BOILER installed in a large Southern plant. This unit is fired by coal, using C-E Spreader Stokers (continuous discharge type). Capacity of this boiler is 150,000 lb of steam per hr at a pressure of 900 psi and a temperature of 808 F.



VU-50 BOILER installed in Midwestern plant. This boiler is fired with pulverized coal using C-E Raymond Bowl Mills. The capacity is 65,000 lb of steam per hr. Steam pressure is 400 psi — steam temperature is 600 F.



VU-10 BOILER fired with oil. Installed in an Eastern plant, the boiler's capacity is 15,000 lb of steam per hr at 250 psi and 480 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or chain grate stokers.

Industries follow the leaders to VU

In industry after industry, you'll find leading companies are setting the pace for efficient, reliable steam production with C-E Vertical-Unit Boilers.

The Chemical Industry is a typical example. For VU Boilers have been purchased by most of the major manufacturers in this industry, including such nationally-known leaders as those shown in the list below.

Furthermore, chemical manufacturers, both large and small, have *proved* their satisfaction with Vertical-Unit Boilers by buying them again and again. In 1951, for example, more than 60 per cent of the VU capacity ordered by chemical companies represented repeat order business. One leading manufacturer, in fact, has purchased twenty-seven units during the past twelve years — *eleven of them in 1951!*

You can profit from the experience of the Chemical Industry — as from any industry where steam for power or process is of major importance. If you use steam, investigate the lower steam costs you can get through the advanced design . . . sound construction . . . proved reliability of VU Boilers. They are available in capacities to fit your needs — from 10,000 to 350,000 pounds of steam per hour.

Typical List of Chemical Companies that have purchased VU Boilers for one or more plants

Air Reduction Co., Inc.
Allied Chemical & Dye Corp.
Atlas Powder Co.
Carbide & Carbon Chemical Corp.
Colgate-Palmolive-Peet Co.
Diamond Alkali Co.
E. I. du Pont de Nemours & Co., Inc.
B. F. Goodrich Chemical Co.
Hercules Powder Co.
Merck & Co., Inc.
National Distillers Chemical Co.
Pennsylvania Salt Mfg. Co.
Pittsburgh Coke & Chemical Co.
Charles Pfizer & Co.
Shell Chemical Co.
U. S. Industrial Chemicals Co.

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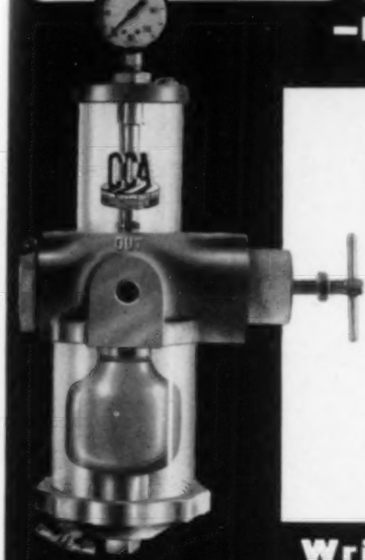

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—FILTER
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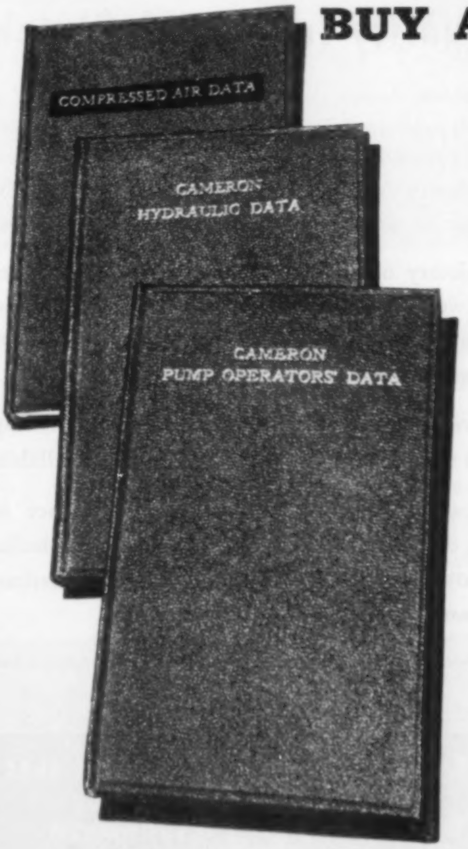
DEZURIK SHOWER CO. SARTELL, MINN.



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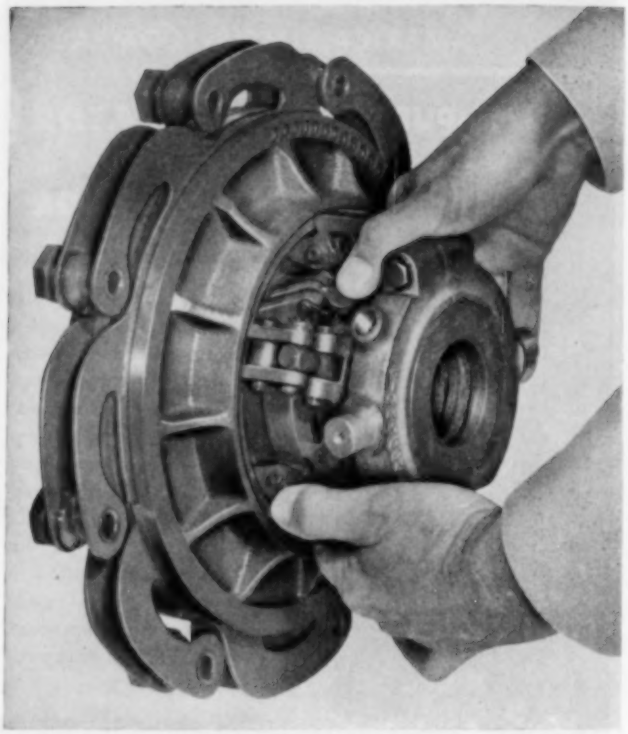

Over-center Double Flex-Disc, showing method of adjusting for wear by releasing thumb latch and turning toggle assembly.

The Over-Center *Flex-Disc

A Quality Industrial Clutch

Low power losses, low maintenance costs, and a long, dependable service life characterize our Over-center *Flex-Disc* and Solid Disc friction clutches. These heavy duty, general purpose industrial clutches range in size from 275 to 19060 lbs.-ft. torque.

The history of the *Flex-Disc* type of clutch goes back twelve years, during which time it has been used by Ingersoll-Rand in their portable line of air compressors.

A corresponding Solid Disc Clutch with bolted up disc in two halves for easy removal is also available.

Our twenty years of engineering experience in clutch design is at your disposal. Write for bulletin 5003 for further information and specifications on Over-center clutches.

*U. S. Patent Nos. 2,177,362; 2,259,461; 2,303,201 and others pending.

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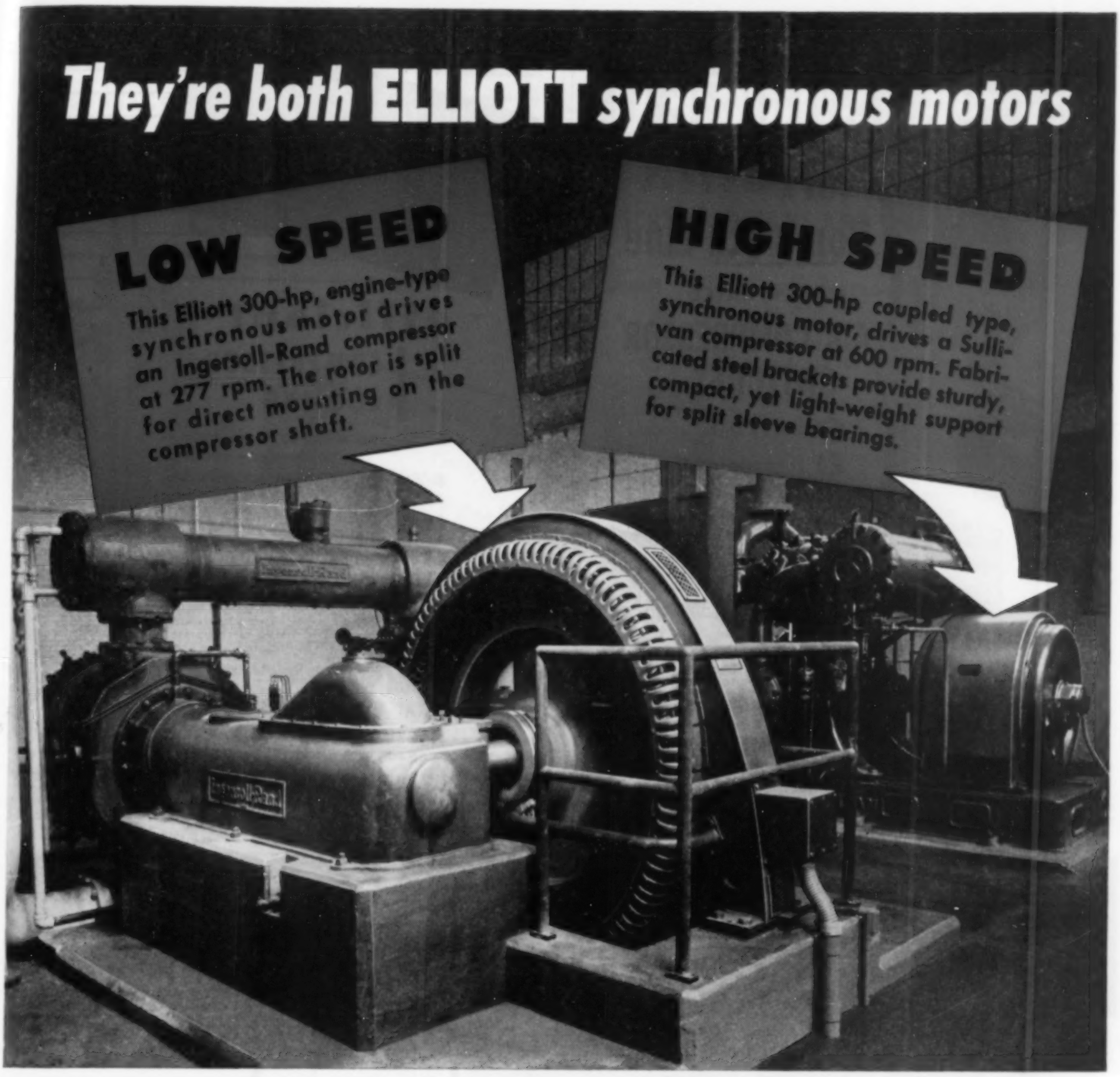

LOW SPEED

This Elliott 300-hp, engine-type synchronous motor drives an Ingersoll-Rand compressor at 277 rpm. The rotor is split for direct mounting on the compressor shaft.

HIGH SPEED

This Elliott 300-hp coupled type, synchronous motor, drives a Sullivan compressor at 600 rpm. Fabricated steel brackets provide sturdy, compact, yet light-weight support for split sleeve bearings.

All Elliott synchronous motors feature "Fabri-Steel" construction to provide extreme ruggedness, uniform air gap, simplicity of maintenance, and other characteristics of long life and improved performance. Get all the facts. Write today for Synchronous Motor bulletins PB5600-1 (high-speed) or PB5000-1 (low-speed). Address Dept. CA.

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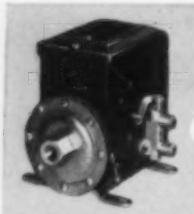

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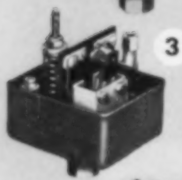

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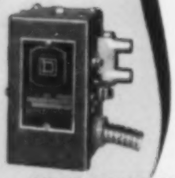

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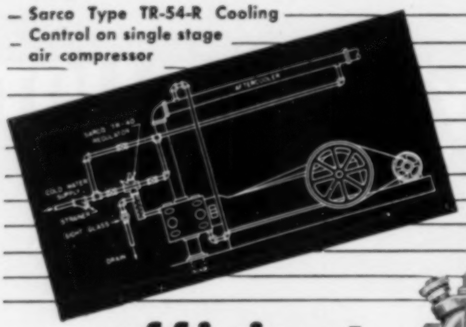

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- Do you want to save cooling water and lubricants?
- Do you want to increase the efficiency and life of your air compressor? . . . then install SARCO COOLING CONTROLS

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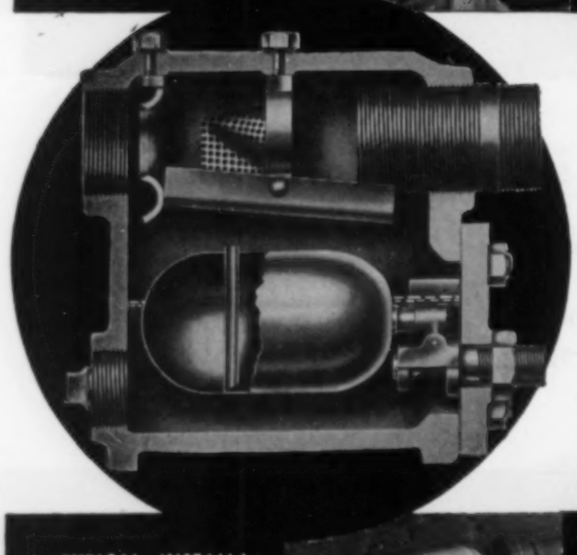

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• DriAir separates and automatically ejects the condensed water and oil from compressed air lines, collects pipe scale and rust, delivers clean dry air to tools and other pneumatic equipment. This promotes better lubrication, reduces wear, increases life of tools and produces greater output. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.

A TYPICAL INSTALLATION SHOWING DRI AIR STANDING ON A CONCRETE FLOOR NEXT TO THE WALL.

WRITE FOR BULLETIN DA WHICH FULLY DESCRIBES THE CONSTRUCTION AND OPERATION OF THE DRIAIR.

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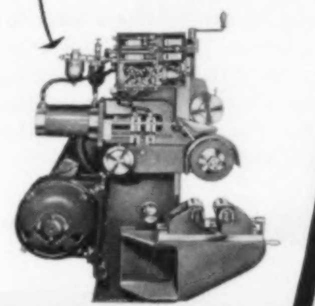

• Write, now, for details on this application... Norgren Blueprint No. 116 ...and how Norgren products may help solve your problems.

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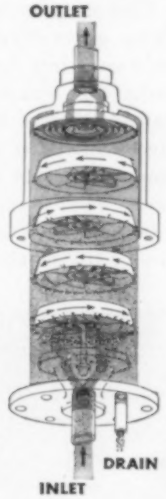
EQUIPMENT LASTS LONGER ...PERFORMS BETTER... when the

ARIDIFIER

SCRUBS, CLEANS AND DRIES On Air and Gas Lines



LASTS LONGER because...
The Aridifier's patented centrifugal-baffle action traps 92% of all dirt, oil, scale and water in gas or compressed air . . . and drains off these troublemakers *before* they can damage tools and equipment.

PERFORMS BETTER because...
The Aridifier protects tools against the freezing, fouling, caking and corrosion caused by dirt and foreign matter . . . assures the clean, dry air and gas that means better spray work, painting, lacquering, sand blasting, air cleaning, and similar operations.

Easily installed, the Aridifier maintains itself. 10 models. Capacity range; 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.
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Logan ENGINEERING CO.
4915 W. Lawrence Ave., Chicago 30, Ill.

Kicker Arms . . . powered by NOPAK Cylinders

. . . sweep boards from Conveyor to Transfer Belts

An important phase of the panel-gluing operation at Potlatch Forests, Inc., Lewiston, Idaho, is the transfer of boards coming from the glue applicator on a conveyor belt to the transfer belts which deliver them to the electronic gluer.

As each board hits the "bumper", a solenoid valve, controlled by a microswitch, actuates a NOPAK Model "E" Cylinder. The cylinder piston rod is coupled by bell-crank linkage to roller-tipped kicker arms which swing in a horizontal arc over the conveyor belt to sweep the board off the conveyor belt to the transfer belts which run at right angles to it.

This materials-handling operation is typical of many similar applications in which NOPAK Valves and Cylinders are used. For others see the NOPAK Application Manual.

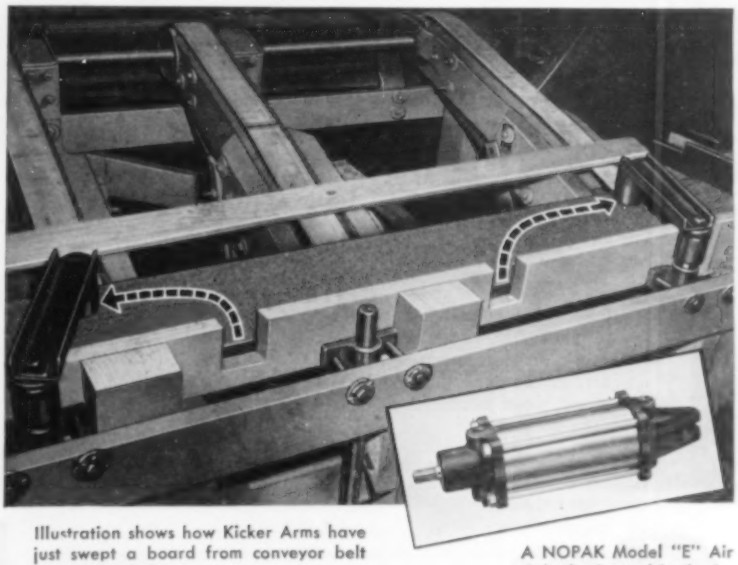

Illustration shows how Kicker Arms have just swept a board from conveyor belt to transfer belts.

A NOPAK Model "E" Air Cylinder is used in the installation pictured.

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2759 S. 31st STREET • MILWAUKEE 46, WISCONSIN
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NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

Refer to Sweet's File for Product Designers or write for Bulletin SW-1.

A 7250-½-H

Compressor gives the air to wear *with help of TIMKEN® bearings*

MORE air—less care! That's what T. B. Wood's Sons Company of Chambersburg, Pa., is getting from this Ingersoll-Rand ES-1 compressor that feeds air to its foundry and machine shop.

To help keep compressors like this in dependable operating condition at lowest cost, Ingersoll-Rand mounts the crankshaft on Timken® tapered roller bearings. This means less wear—less care. Smooth, friction-free operation is assured.

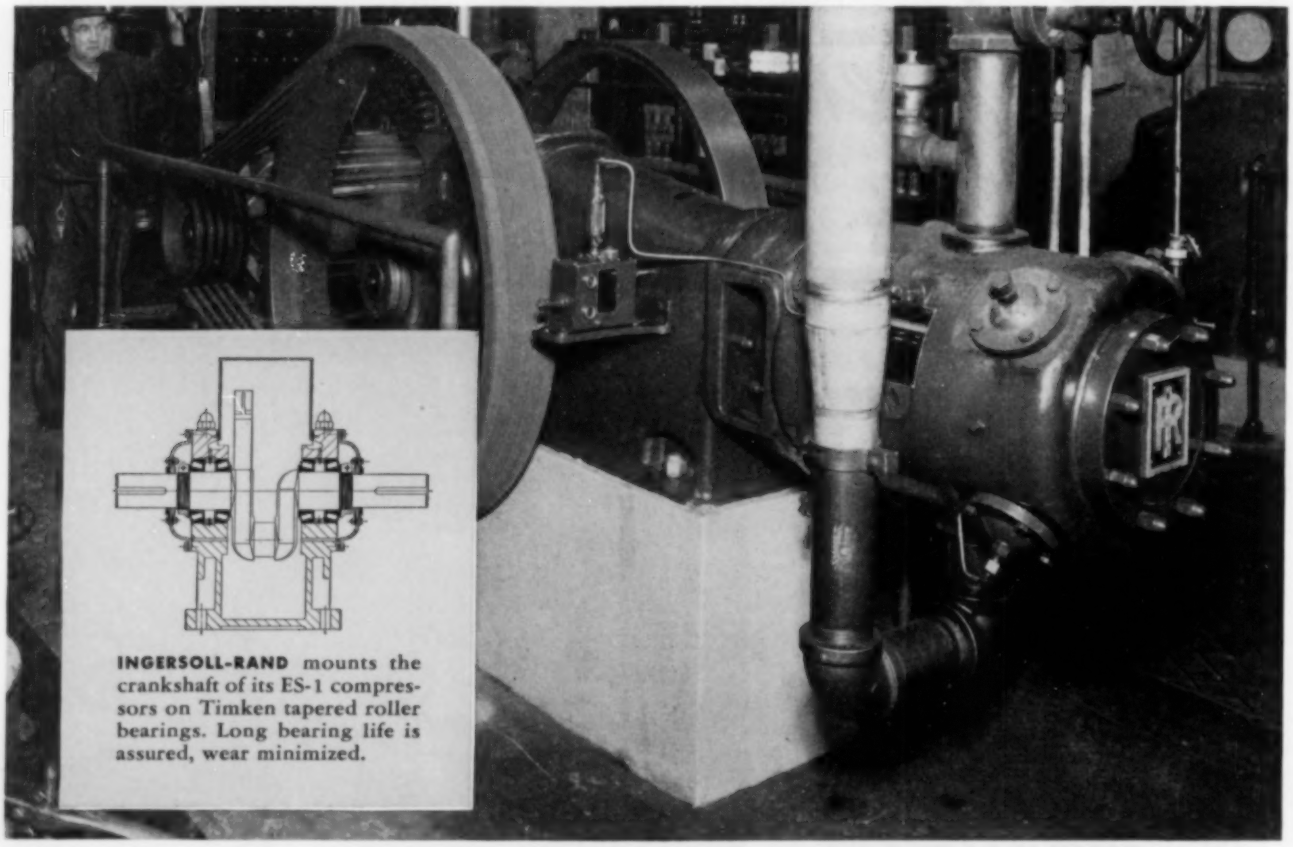
Because Timken bearings keep housings and shafts concentric, closures are more effective—dirt is kept out, lubricant kept in. Lower maintenance and lubrication costs result.

Line contact between rollers and races gives Timken bearings extra load-carrying capacity. They carry radial and thrust loads in any combination because of their tapered construction. True rolling motion and smooth surface finish of rollers and races make friction negligible. And Timken bearings normally last the life of the machine.

No other bearing gives you *all* the advantages you get with Timken bearings. They're best in the machines you build; your assurance of dependability in the machines you buy.

Be safe! Be sure! Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

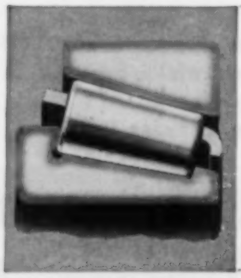


INGERSOLL-RAND mounts the crankshaft of its ES-1 compressors on Timken tapered roller bearings. Long bearing life is assured, wear minimized.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



GREATER LOAD AREA

Because the load is carried on the *line* of contact between rollers and races, Timken bearings carry greater loads, hold shafts in line, wear longer. The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

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YOUR MEN *asked for these* AIR GRINDER FEATURES!

For increased production, dependability and safety, check your present portable grinding equipment against these Ingersoll-Rand features:

Overspeed Safety Coupling—If the regular governor, because of wear, abuse, improper adjustment, or dirty air, allows the motor to overspeed, the overspeed safety coupling automatically disconnects the arbor and the wheel from the motor.

Quieter Exhaust—It takes 10 of these Grinders to produce exhaust noise equal to that of one previous machine! This means increased operator morale and top grinding efficiency!

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Easy to Carry—There is plenty of room behind the throttle lever for a comfortable grip. The Grinder may be easily and safely carried while it is connected to the air line.

More Power—A larger motor maintains higher speed under normal grinding loads to remove more metal in less time.

Optional Handle—The popular grip handle is interchangeable with a straight handle where the operator's preference or the job at hand calls for it.

Long Life Arbor Construction—Widely spaced, permanently lubricated ball bearings maintain rigidity and accurate alignment, assuring long life and trouble-free service.

Rubber-Faced Valve—For air economy the rubber-faced throttle valve seats better under all conditions, even with a dirty or pitted valve seat.

Call, write or wire your nearest Ingersoll-Rand office—one of our Grinder engineers will demonstrate what Operator Engineered Grinders can do on your jobs!

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A Texaco Lubrication Engineer will gladly help you select the proper Texaco air compressor oil to give you best performance. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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